CANADA'S MODEL FOREST PROGRAM

A USER'S GUIDE TO LOCAL LEVEL INDICATORS OF SUSTAINABLE FOREST MANAGEMENT: EXPERIENCES FROM THE CANADIAN MODEL FOREST NETWORK

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Ressources naturelles Canada

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THE CANADIAN FOREST SERVICE

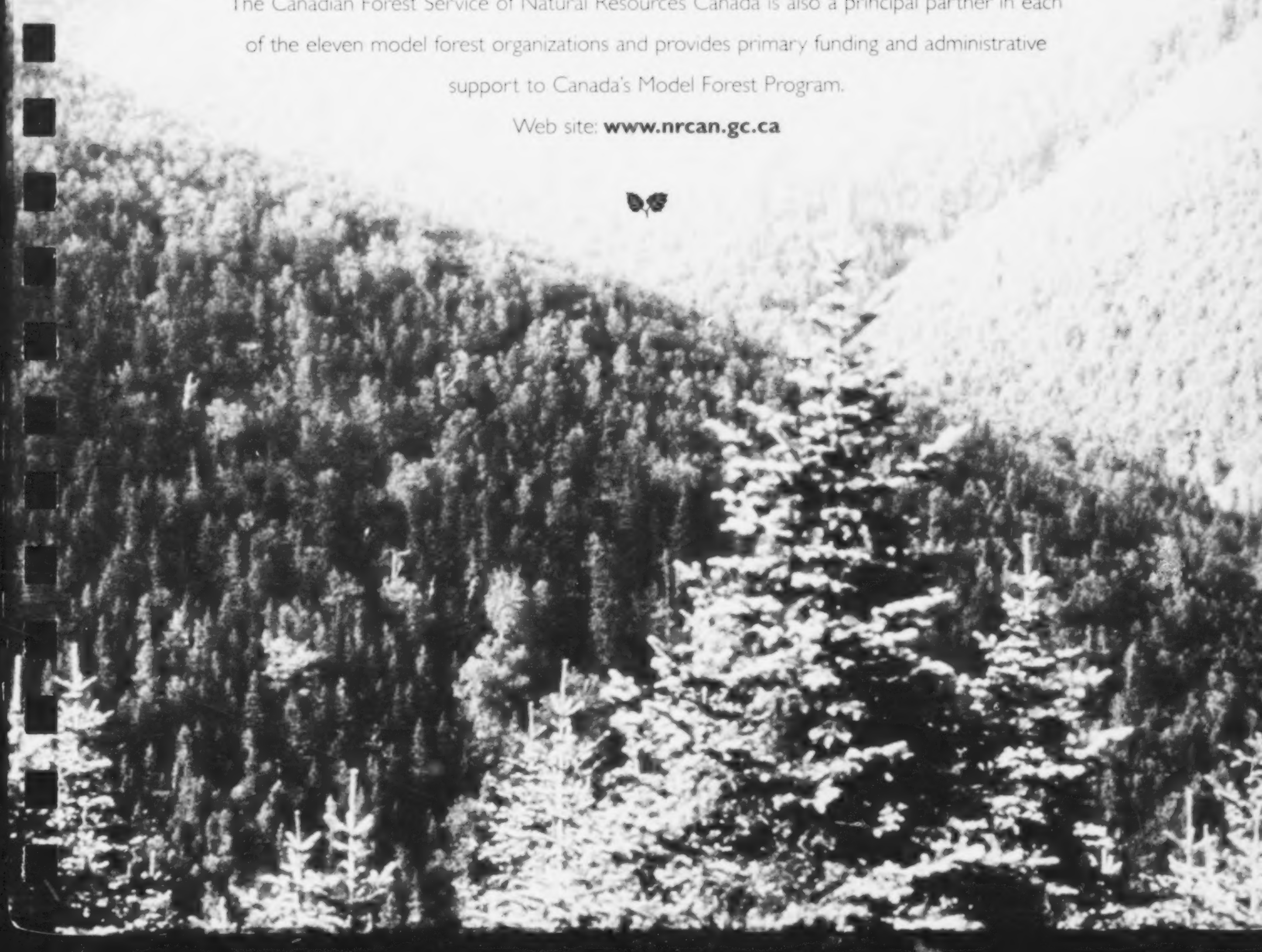
MISSION

"To promote the sustainable development of Canada's forests and competitiveness of the Canadian forest sector for the well-being of present and future generations of Canadians."

Canada has taken the lead in researching ways to sustain and enhance our forests. The Government of Canada, through the Canadian Forest Service, initiated the Model Forest Network in 1992. It introduced this system of 11 Canadian and a number of international research sites "dedicated to building partnerships locally, nationally, and internationally to generate new ideas and on-the-ground tools for sustainable forest management". This process has brought together hundreds of partners including academia, industry, government, communities, aboriginal peoples, the public, and other stakeholders.

The Canadian Forest Service of Natural Resources Canada is also a principal partner in each of the eleven model forest organizations and provides primary funding and administrative support to Canada's Model Forest Program.

Web site: **www.nrcan.gc.ca**



WHAT IS A MODEL FOREST?

A model forest is a place where the best sustainable forest management practices are developed, tested and shared across the country. Each model forest is run by a not-for-profit organization, and, except for a small administrative staff, all those involved in the model forest not only donate their time and expertise, but usually bring additional financial support.

At the heart of each model forest is a group of partners having different perspectives on the social, economic and environmental dynamics within their forest — perspectives that are necessary make more informed and fair decisions about how to manage the forest. The real "model" in these forests is the way the different partners — logging companies, Aboriginal communities, maple syrup producers, woodlot owners, parks, environmentalists, universities, government agencies, recreational groups, community associations, hunters, trappers — have integrated their own interests into their common goal of developing approaches to sustainable forest management that do not sacrifice one interest for another.

Although the model forest organization itself does not have jurisdiction over the land it uses as a testing ground, those who do have jurisdiction are participants. By being involved from the outset in developing new, on-the-ground approaches and solutions for sustainable forest management, those with land management responsibilities are increasingly adopting many of the model forest suggestions.

Model Forest Network web site: **www.modelforest.net**

CANADA'S MODEL FOREST PROGRAM

A USER'S GUIDE TO LOCAL LEVEL INDICATORS OF SUSTAINABLE FOREST MANAGEMENT:

EXPERIENCES FROM THE CANADIAN MODEL FOREST NETWORK

The report has been prepared by a consultant, Martin von Mirbach, for the information purposes of the Canadian Model Forest Network. This is not an official publication of the Canadian Forest Service or Canada's Model Forest Program. Any opinions expressed do not necessarily reflect the views of the Canadian Forest Service or the Canadian Model Forest Network.

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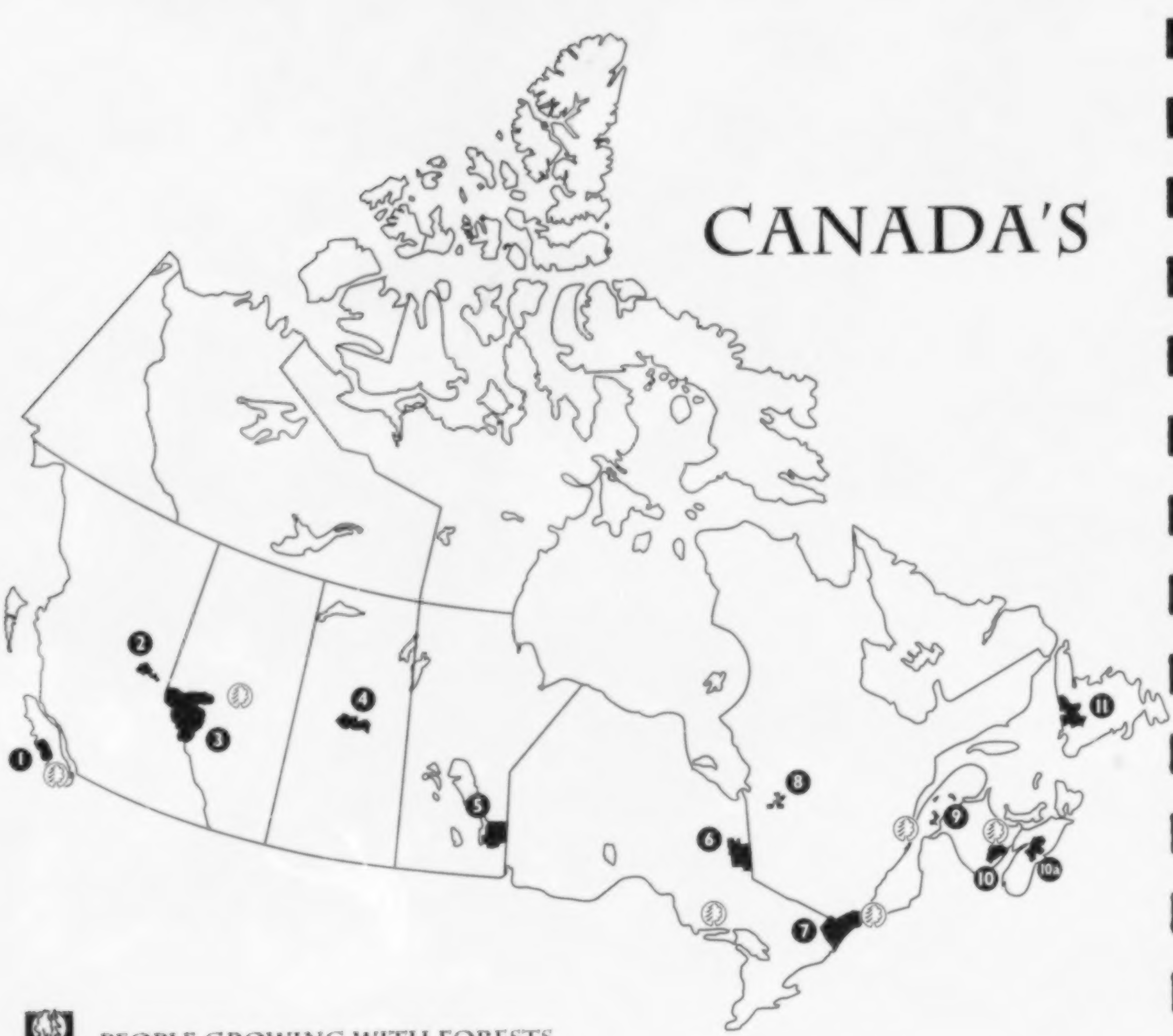
CANADA'S



PEOPLE GROWING WITH FORESTS

Did you know that Canada holds 10% of the world's forests? We all love forests. Forests are Canada's natural wealth. They provide clean air and water, habitat for wildlife and, for many Canadians, a place to work. Tranquil and yet teeming with life, forests also provide for spiritual and recreational moments.

In the early 1990s, Canadians faced an important question: How can forests be managed so that today's decisions don't compromise the choices of future generations? The key to this question is Sustainable Forest Management (SFM).

The Canadian Forest Service (CFS) believes that partnership is at the heart of SFM. In 1992, the CFS launched Canada's Model Forest Program that openly invited Canadians, having an interest in the future of our forests, to work together in partnership.

Today, eleven model forests are found in Canada's major forest regions. The Canadian Forest Service is also a principal partner in each Model Forest organization and provides the primary funding and administrative support to Canada's Model Forest Program. The partners in each model forest share their forest values and expertise to help develop new forest management approaches based on local forest conditions. They use their model forest area as a giant, hands-on laboratory where they design, research, and develop new methods that they share, implement and monitor.

Through the Model Forest Program, Canadians have demonstrated the value of this partnership concept to other countries. Today, other model forests around the world are working to find their local solutions to the global challenge of SFM.

At the Canadian Forest Service, we are proud of the Canadian Model Forest Network, and what is most rewarding is the dedication and determination shown by the hundreds of Canadians who devote their own time to their model forest. Model forests are working to show world leadership in SFM, and CFS's researchers and forestry professionals are delighted to be a part of this success.

MODEL FOREST PROGRAM

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INTRODUCTION

The pursuit of sustainable forest management requires the monitoring of effects resulting from our management practices and activities. Criteria and indicators for sustainable forest management have been developed through the Canadian Council of Forest Ministers to allow for the measurement of progress along national scales, and through various international processes to do the same at the international scale. Local level indicators, which are developed to suit local and regional conditions, provide the framework for monitoring on-the-ground changes and assessing their influence on the many components of sustainable forest management.

A model forest is a place where the best sustainable forest management practices are developed and tested on local forest areas then shared across the country. At the heart of each model forest is a group of partners having different perspectives on the social, economic and environmental dynamics within their forest — perspectives that are necessary to make more informed and fair decisions about how to manage the forest.

A model forest is ideally suited to develop and effectively apply widely acceptable indicators of sustainable forest management at the local level because of its broad partnership base and perspectives representing a diversity of forest values. As a common starting point, however, each model forest utilized Canada's **six criteria** for sustainable forest management as defined by the Canadian Council of Forest Ministers.

THE MODEL FORESTS that make up the Canadian Model Forest Network have been intensively involved in selecting, measuring and reporting on local level indicators since 1997. This activity has been carried out by individual model forests, and has also been assisted by initiatives supported by the Local Level Indicators Strategic Advisory Committee, made up of model forest presidents and general managers as well as Canadian Forest Service representation. After having achieved significant progress, along with encountering and surmounting numerous unforseen barriers and difficulties along the way, the Local Level Indicators Strategic Advisory Committee identified the need for a major document that would compile and describe the information on local level indicators that the Canadian Model Forest Network has developed to date. The document would cover information on processes, protocols and methodologies developed for the identification, development, monitoring, reporting, use and application of local level indicators. The document would essentially be a "how-to" manual on local level indicators, based on work done to date within the model forests. The present report is intended to address that need.

PART TWO of this report (immediately following this introduction) provides a general overview of Canada's Model Forest Program and its involvement in local level indicators. It includes a short history of the Model Forest Program, followed by a brief introduction to the topic of criteria and indicators for sustainable forest management. The remaining two sections outline in a general sense the relevance of local level indicators to model forests as well as the role of model forests in furthering local level indicator initiatives in Canada.

PART THREE focuses on each model forest in turn, moving from east to west. Each section includes a brief general overview, and then describes the process of local level indicator development and use in a series of logical steps or stages:

- getting started (forming a committee, developing a work plan, etc);
- selecting indicators (screening potential indicators, refining and testing them);
- gathering data (assessing existing data, assigning roles and responsibilities); and
- using and reporting on indicators.

At each stage in the process model forests share their own perspectives about particularly relevant lessons they've learned and experience gained. Each section includes a brief summary of priority action items in the coming year, a list of publications available, and contact information for further inquiries. Lastly, each section includes a listing of the core local level indicators in use at each model forest, providing specific information on how the data is to be gathered.

PART FOUR offers a brief overview of the major indicator-related initiatives supported by the Canadian Model Forest Network, especially through its Strategic Initiative on Local Level Indicators.

PART FIVE provides an overview of the diversity of approaches used by model forests at each step in the process. The section includes numerous insights based on the collective experiences of model forests across the country, including key lessons learned as well as compilations of information on:

a) criteria used to evaluate indicator quality and appropriateness;

b) a generic checklist for data requirements;

c) approaches to simplifying data collection; and

d) addressing challenges in data collection.

Appendix A provides a consolidated matrix that combines all indicators selected by model forests, with the exception of the Waswanipi Cree Model Forest's indicators which uses a significantly different framework of criteria that doesn't allow for easy amalgamation. Many indicators are in common use across most of the Model Forest Network, and these commonalities are noted here.

Appendix B is a glossary of terms relevant to local level indicators and the Canadian Model Forest Network.

Appendix C is a list of acronyms and abbreviations in use in this report.

Appendix D is a bibliography of material available from the Model Forest Network and/or individual model forests.

Appendix E contains information on the CD-ROM included with this Users' Guide. The CD-ROM contains all the files in the document marked with the following CD-ROM symbol: 💿

ACKNOWLEDGEMENTS

This project would have been inconceivable without the dedicated support of the late Dan Welsh, Director of Programs, Canadian Forest Service. He challenged all model forests in Canada to engage actively in developing local level indicators, and then ensured that the support was available for them to do this effectively. The accomplishments reported on in this User's Guide describe the important achievements of model forests and model forest partnerships, but should also be appreciated as tangible, practical evidence of Dan's invaluable efforts as a catalyzing agent.

The author offers grateful appreciation for the considerable support and assistance provided by many people without whose contributions this report could certainly never have even been completed.

This report has benefited tremendously from the research conducted by Jeremy Williams and Chris Wedeles of ArborVitae Environmental Services Ltd.

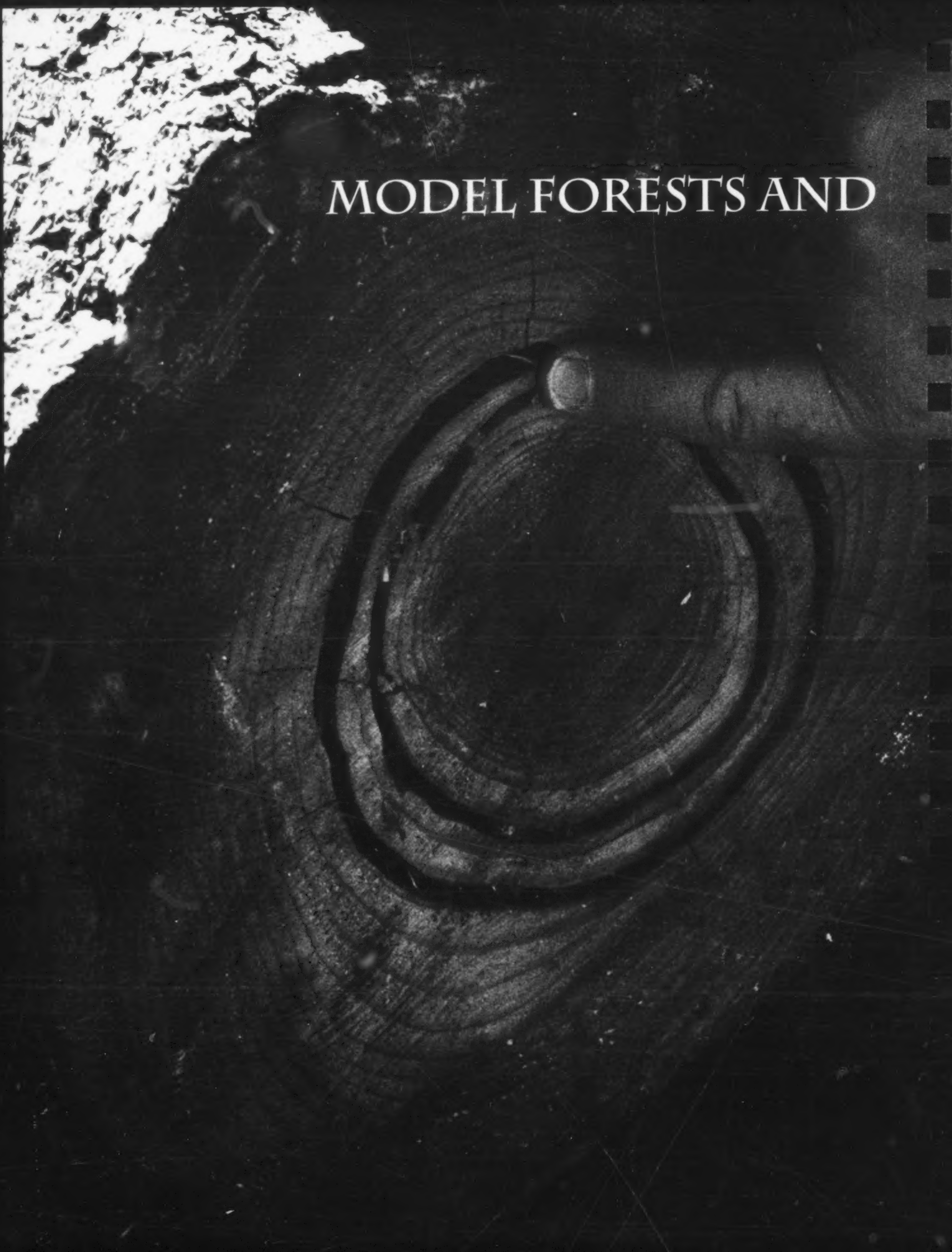
Paul Arnold (Western Newfoundland Model Forest) prepared the tables providing detailed information on local level indicators in use at each model forest, and also updated the consolidated matrix of indicators as well as the glossary.

Many individuals involved in model forests across the country helped to supply the information included in this report and were gracious in providing this information under tight time constraints: Brian Barkley, Barbara Beasley, Pierre Belleau, Brian Belyea, Keith Chaytor, Dick Dempster, Sharon Desjarlais, Sean Dolter, Steve Dominy, Dwayne Dye, Peter Etheridge, Glenda Garnier, Trevor Griffin, Susanne Hilton, Elizabeth Holmes, Glen Hurley, Jason Kostopoulos, Derek MacFarlane, Keith McClain, Len Moores, Sue Parton, Kevin Pugh, Sheila Robinson, Ken Runyon, Richard Savard, Mark Storie, Brian Sykes, Jim Taylor, Dean Toole, Bodo von Schilling, Mike Waldram and Maureen Whelan.

Brian Bonnell (Canadian Forest Service) provided outstanding and exemplary assistance in tracking down and compiling a huge amount of information on local level indicators from across the country.

The author is grateful for the support and guidance from the Local Level Indicators Strategic Advisory Committee: Louis LaPierre (chair), Jim Burbee, John Hall, Glen Hurley, Jim Taylor, and Dean Toole.

MODEL FORESTS AND



LOCAL LEVEL INDICATORS

Since the early 1960s the world has become aware of the limits to growth and the need for what the 1987 Brundtland Commission termed "sustainable development": meeting the needs of the present without compromising the ability of future generations to meet their needs. At the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, the concept of sustainable development began its arduous journey from principle to practice with Agenda 21 and international conventions on biological diversity, climate change and desertification. At the same time, world leaders acknowledged the crucial role of healthy forests in sustainability by signing the Forest Principles, a statement designed to guide the management, conservation and sustainable development of all types of forests.

> ***...since ecological, social and economic conditions vary from place to place, there is no single, universal formula for sustainable forest management.***

The challenge of sustainable forest management took on particular urgency in Canada. With 10 percent of the world's forests and as the world's largest exporter of wood and paper products, Canada clearly has a special responsibility, both to its own citizens and to the world at large, to sustainably manage its forests.

By March 1992, the Canadian forest community had developed a new comprehensive National Forest Strategy and Canadian Forest Accord which incorporated the principles of sustainable development into an action plan for forestry in Canada. As well, new legislation was formulated to protect sensitive areas and ensure that companies seek input from relevant stakeholders in the preparation of forest management plans.

However, in this time of growing social concern for better environmental management, it was clear from the beginning that the issues were too great to be amenable to purely legislative or regulatory change. Top-down solutions contain little practical guidance for those wanting to make specific changes in the way they manage the forest at the local level. Moreover, since ecological, social and economic conditions vary from place to place, there is no single, universal formula for sustainable forest management.

A SHORT HISTORY OF CANADA'S MODEL FOREST PROGRAM

It was in the early 1990s when the idea for what became known as Canada's Model Forest Program first began to take shape. The Canadian Forest Service (then known as Forestry Canada) recognized the need for a neutral forum or "roundtable" that was respectful of individual interests but was united in the difficult job of putting the pieces together. Model forests were designed as living laboratories where people with a direct interest in the forest, supported by the most up-to-date science and technology, could participate in decisions about how the forest could be sustainably managed.

Phase I: 1992–1997

In 1991, an independent National Advisory Committee on Model Forests was appointed by the federal government. This committee was charged with designing and administering a competitive process that would lead to the selection of a network of model forest sites. After a review of 50 proposals, the committee recommended a network of ten sites representing Canada's major forest regions.

Not surprisingly, most model forests went through a difficult initiation as people who had been at odds for years accepted the difficult task of agreeing about what they would need to do in their forest to ensure its sustainability. No one had tried anything like this before, and the first few years were spent trying to decide what was important and how to reach consensus about what should be done. It soon become clear to each participant that an essential part of the struggle to find ways to work together was to become as informed as possible about what was really going on in the forest.

Phase I can very much be characterized by a focus on the local partnership, the development of effective working relationships and frameworks, the enhancement of knowledge of local conditions, and a commitment to work together towards a common goal.

Three years into the Program, the federal government commissioned an independent committee of Canadian forest experts to conduct a comprehensive evaluation. The experts noted that the Program had been successful in creating partnerships among the people and organizations who had traditionally been in conflict. The evaluators recommended that participants in the model forests implement what they had learned about sustainable forest management practices and put more energy into communicating the results of their work to more people. As well, the evaluation revealed that many model forests were flourishing partly as a result of the unique perspective provided by their Aboriginal partners and suggested that the level of Aboriginal involvement in all model forests be increased.

After studying the evaluation report and conferring extensively with forest stakeholders, the Canadian Forest Service designed the second phase of the Program.

PARTNERSHIP BUILDING FOR SUSTAINABLE FOREST MANAGEMENT

Forest management in Canada has become more complex and information demands are multiplying. Conserving biodiversity, protecting wildlife habitat and certifying forest products require new knowledge and skills. Getting a holistic view of the forest is impossible if the individuals who hold these diverse values work in isolation. No one person has all the information, or all the answers. A large part of sustainable forest management is bringing different perspectives, and the people who hold them, together.

The Canadian Model Forest Network is built upon a foundation of partnerships. These partnerships have developed and been strengthened both within and among the model forests. Within each, there exists a partnership consisting of a broad range of interests which may include educational institutions; industry; Aboriginal groups; local, provincial, and federal governments; community and public interest groups; environmental non-governmental organizations; recreationalists; and many others. The Model Forest Network provides an opportunity for those with an interest in natural resource management to come together as a community to assist forest managers in resolving the challenges that confront them. It also provides a forum through which all interested parties can express their opinion. The strength of the Network lies in the fact that each of these partners has a voice in the overall decision-making of the model forest.

Model forest partnerships aid in building a balance of respect, equity, and empowerment between the diverse groups that get involved — three critical components in the advancement of sustainable forest management. The partnership thus created has strong network ties to all facets of the resource community and allows establishment of meaningful two-way communication between the partners. This structure will go a long way toward enabling forest managers to determine the management planning process that is required to provide a sustainable supply of goods and services from the forest without jeopardizing its biodiversity, ecosystem integrity, or productive capacity.

Partnerships may create new challenges and increase the complexity of current ones, but they also offer the chance to share information, to make tradeoffs between conflicting objectives, and to develop better and more effective solutions to resource management issues. Model forests are showing that the partnership approach, although time-consuming, leads to better and more sustainable decisions.

Phase II: 1997–2002

Phase II (1997–2002) of Canada's Model Forest Program focuses on sharing the model forest experience beyond the model forest organizations, demonstrating model forest innovations, and establishing an 11th model forest managed by Aboriginal people. A particular emphasis is placed on innovations that can be used by other forest stakeholders throughout Canada. One particular example of this is the establishment in Nova Scotia of a Model Forest Project, intended to explore the potential for rapid knowledge transfer from an existing model forest (Fundy Model Forest) into a separate region — indeed, a separate province. In Phase II, the Canadian Forest Service became a full member of the board of each model forest. This increased involvement strengthened its role in improving alliances between model forests and other sustainable forest management initiatives and in bringing the model forest story to the nation's attention.

Phase II was also designed to support the model forests in working together as a network on sustainable forest management issues relevant to all model forests. Four new strategic initiatives were introduced in Phase II to enhance network-level participation in these issues: Local Level Indicators, Enhanced Aboriginal Involvement, Communications, and Translation.

A map showing the location of all model forests is included after the Table of Contents.

CRITERIA AND INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT

The need for criteria and indicators of sustainable forest management became an international priority following the 1992 UNCED conference in Rio de Janeiro. At that conference the international community recognized that putting the principle of sustainable development into practise is no easy task, especially in the field of forests and forest management where there are a bewildering number of variations around the world in terms of ecosystem types, economic conditions, social expectations and institutional capacity.

Since the UNCED conference there has been a growing number of initiatives aimed at identifying criteria and indicators (C&I) of sustainable forest management. These initiatives are intended to:

- provide a common understanding of what is meant by sustainable forest management;
- provide a common framework for describing, assessing and evaluating a country's progress toward sustainability at the national level;
- help provide a reference for policy-makers;
- provide a basis for international cooperation aimed at supporting sustainable forest management; and
- help clarify ongoing dialogues related to international trade in products from sustainably managed forests.

In 1994 the Canadian Council of Forest Ministers (CCFM) convened a process to develop criteria and indicators of sustainable forest management that would be consistent with relevant international frameworks, but adapted so as to make them more relevant to the Canadian context. After extensive discussions with a wide variety of interests, the CCFM approved a set of six criteria, with more than eighty national-level indicators.

CRITERIA FOR SUSTAINABLE FOREST MANAGEMENT IN CANADA

1. Conservation of biological diversity
2. Maintenance and enhancement of forest ecosystem condition and productivity
3. Conservation of soil and water resources
4. Forest ecosystem contributions to global ecological cycles
5. Multiple benefits to society
6. Accepting society's responsibility for sustainable development

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C&I AND LOCAL LEVEL INDICATORS

Much of the initial interest in criteria and indicators arose from a need to report both nationally and internationally on progress made towards sustainable forest management. However, it soon became apparent that the ability to demonstrate national advancement towards sustainable forest management rests largely with actions that are carried out at the local level. If these local actions are to be assessed it will require indicators that are particularly suited to local needs. In other words, the need for local level indicators arose not just out of a "top-down" imposition of a particular framework, but because "bottom-up" reporting is absolutely *essential* to the whole effort of demonstrating progress at *any* scale.

Since about 1996, discussion about criteria and indicators has increasingly focussed on the need for effective (credible, valid and practical) *local level indicators* of sustainable forest management. The term "local" in this context can be used to refer to areas as small as a particular forest stand, but for the most part "local level indicators" refer to indicators that apply across a particular forest management unit. This might range in scale from a few dozen hectares for a private woodlot all the way up to regions over one million hectares in size.

The national and international policy community, which had initiated discussions on C&I in the first place, recognized the importance of good local level reporting, but has had to look to others for the expertise to actually design and implement local level indicators of sustainable forest management.

At the same time, in response to internal and external policy expectations, as well as to achieve forest certification, forest managers working at the management unit scale became increasingly interested in using local level indicators for their own purposes. Forest certification or registration is a voluntary process through which a forestry company or other organization (including, potentially, a governmental entity) undergoes an independent audit or assessment of its forest management system. Currently, two certification systems specific to forestry are available in Canada: one by the Canadian Standards Association (CSA) and the other by the Forest Stewardship Council (FSC). It is also possible for a forest management system to be certified through the International Organization for Standardization's generic ISO 14001 Environmental Management System. The relevance of these initiatives to local level indicators is that all three of them require managers to monitor the impacts that their activities are having, to use the knowledge gained through this monitoring to assess the effectiveness of the management plan in meeting the diverse goals and objectives, and to modify their actions accordingly.

THE ROLE OF MODEL FORESTS IN LOCAL LEVEL INDICATORS

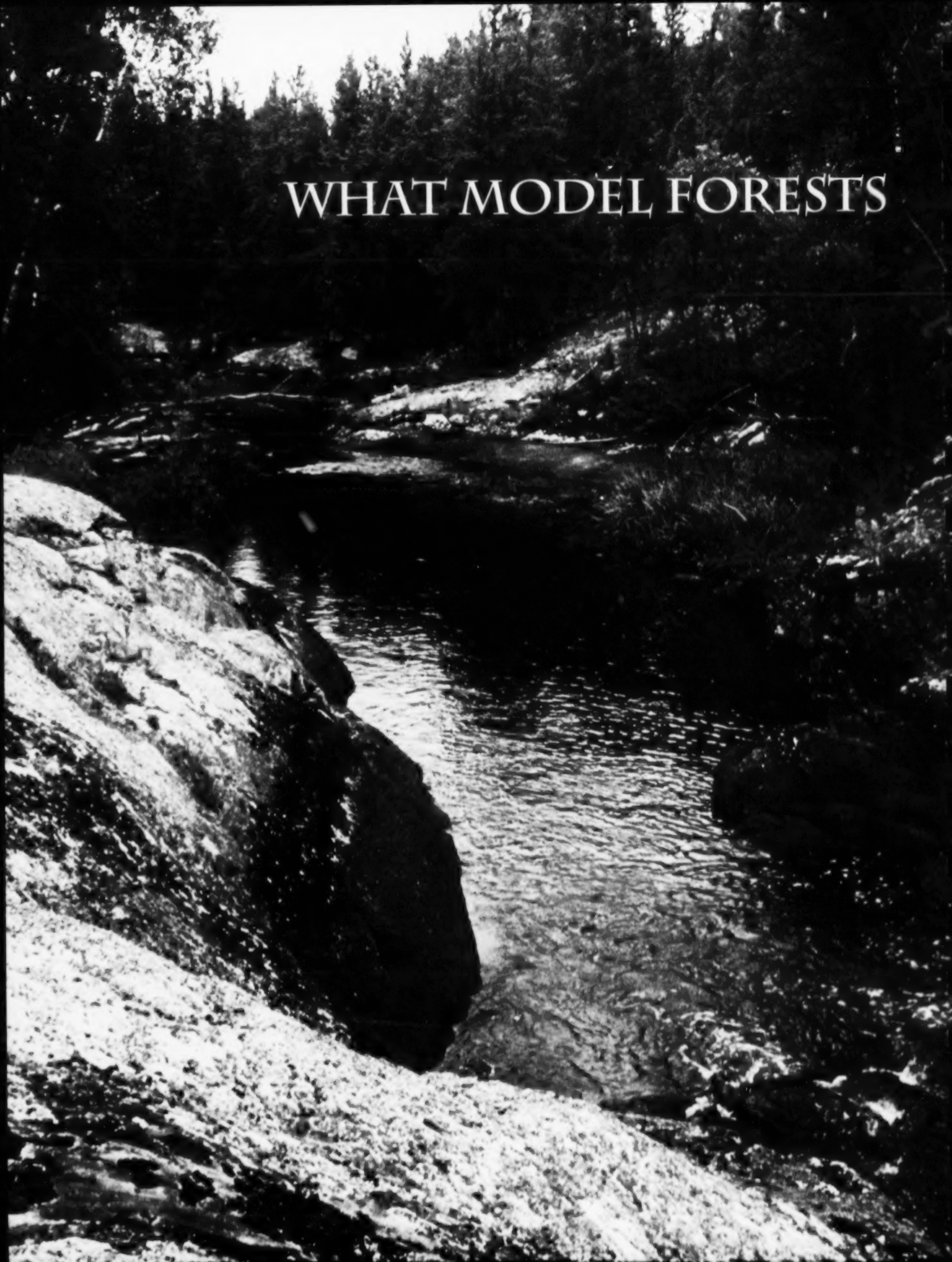
Model forests offer a number of attractive features that make the Model Forest Network ideally suited to help in the development and use of local level indicators.

Scale: Model forests range in size from 113,000 hectares to 2.75 million hectares, which roughly covers the typical sizes of industrial forest management units across the country. As well, four model forests have significant small-scale private holdings, making them good study sites for the use of local level indicators on small forest holdings.

Coverage: Model forests exist in all of the major forest regions of the country. In addition, model forests encompass landscapes from uninhabited wilderness to Aboriginal communities to forestry-dependent communities to sophisticated urban environments, representing a broad range of socio-economic interests.

Diversity: Model forests have broad partnership bases that bring the diversity and perspectives of the full range of forest values. Model forests bring to the table a number of interests that often aren't included in processes that are limited to forest management agencies, including academics, environmentalists, Aboriginal representatives, user groups and community interests. These people have a genuine interest in sustainable forest management, and also have considerable knowledge, experience, expertise and credibility that wouldn't otherwise be available.

WHAT MODEL FORESTS



HAVE ACCOMPLISHED

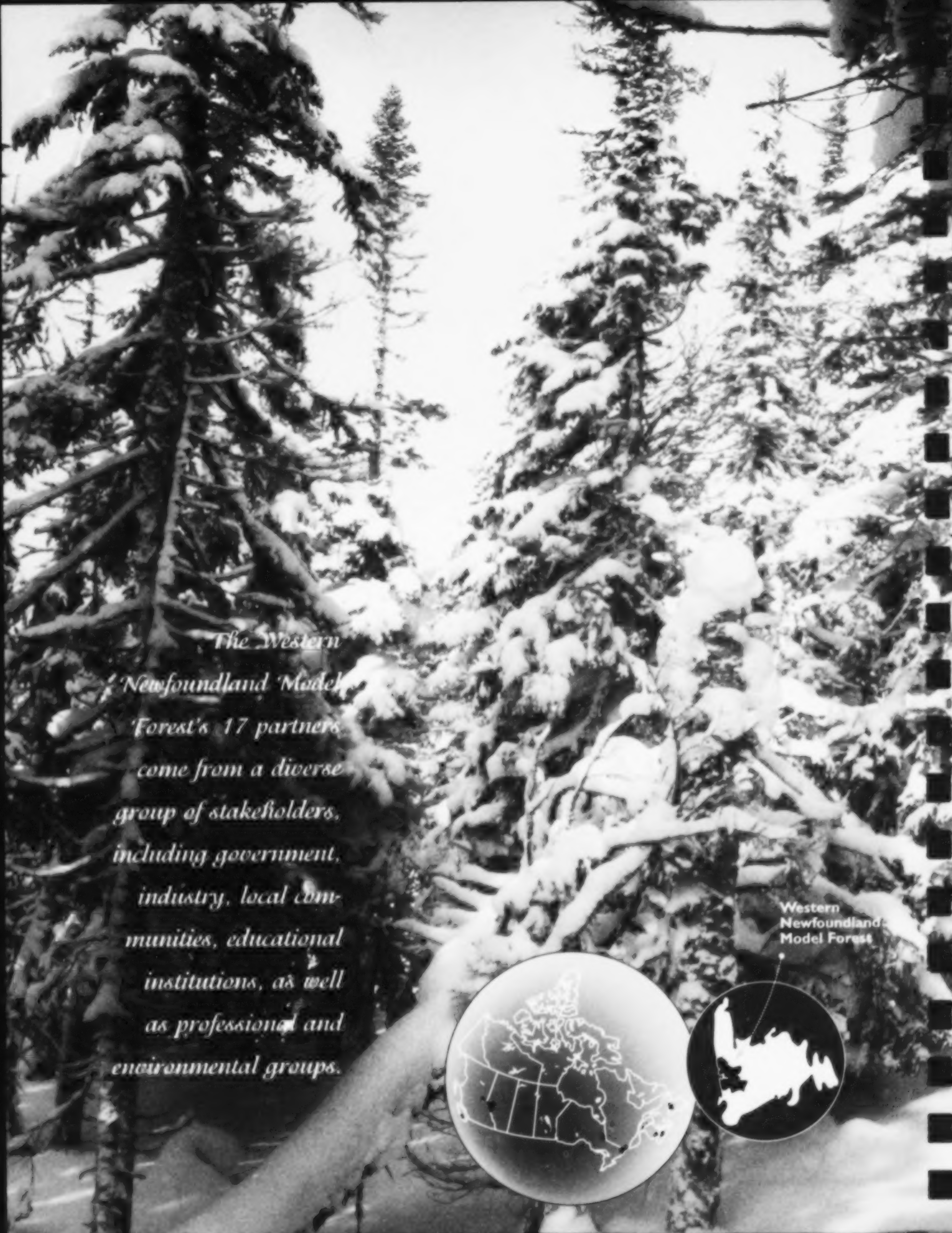
This section is devoted to describing how each model forest in Canada is carrying out the various tasks involved in identifying, measuring and using local level indicators (LLI) of sustainable forest management. In order to allow for comparison between model forests, a similar format is used to describe each model forest's process, as outlined in Table 3.1

Interspersed throughout are text boxes on "lessons learned" and "experience gained." These sections offer observations, comments and advice directly from the model forests themselves.

It is important to note that each model forest's work on local level indicators is still in progress. These descriptions are therefore certain to be incomplete and inaccurate in some details. In particular, model forests are continually revising their lists of indicators currently in use.

TABLE 3.1: STEPS IN EACH MODEL FOREST'S LOCAL LEVEL INDICATORS INITIATIVE

A) Background	•Basic information about each model forest
B) Initiating a program on local level indicators	•Prior activities •Initial purpose •Getting started on the work program
C) Selecting indicators	•Initial indicators •Refining the indicators •Further testing and filling gaps
D) Gathering data	•Initial assessment •Roles and responsibilities •Current status •Ongoing monitoring
E) Using and reporting on indicators	•Brief description of how the indicators are being used
F) Next steps	
G) Publications and reports	
H) Further information	
Table of indicators in current use	•With information on units of measure, scale, measurement interval and source, where available


Western
Newfoundland
Model Forest

The Western Newfoundland Model Forest's 17 partners come from a diverse group of stakeholders, including government, industry, local communities, educational institutions, as well as professional and environmental groups.

WESTERN NEWFOUNDLAND MODEL FOREST

BACKGROUND

The Western Newfoundland Model Forest is made up of 923,000 hectares of boreal forest, including Gros Morne National Park. The area is home to the Newfoundland pine marten, an endangered small mammal.

Its 17 partners come from a diverse group of stakeholders, including government, industry, local communities, educational institutions, as well as professional and environmental groups.

The Western Newfoundland Model Forest is particularly proud of its role in helping the provincial government to establish a pine marten reserve at Little Grand Lake, 20 km southeast of Corner Brook. The Model Forest is also conducting research to determine the impact that forest harvesting, landscape fragmentation and loss of habitat have had on the mammal's declining population.

The Model Forest has established a training program for front-line forest workers that has both classroom and field components. It was designed specifically for front-line forest workers who work for the pulp and paper companies or for independent contractors. This program, unique in North America, is drawing attention from provincial forestry associations across Canada and is currently being modified by staff at Gros Morne National Park for domestic timber cutters who cut within the Park's boundaries.

The Summer Institute in Environmental Education is another initiative that has received support from the Western Newfoundland Model Forest. Using an interdisciplinary approach, this program provides training for 15 to 25 educators annually from across the province aimed at giving them the skills and materials necessary to enable them to integrate the concept of sustainable forest management into their intermediate and secondary school curricula.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

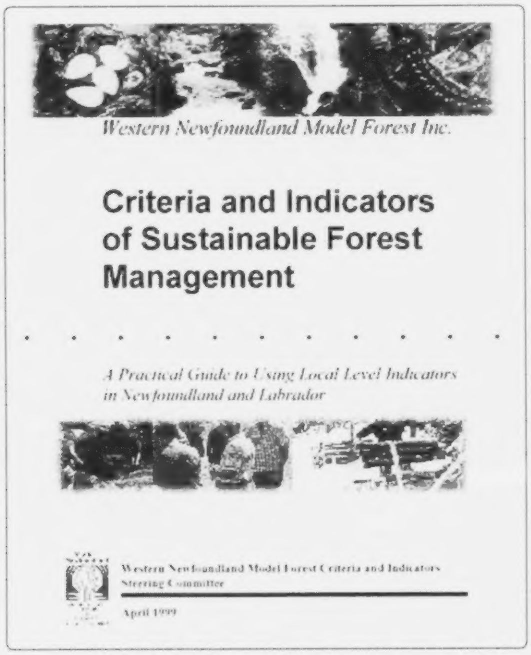
Prior activities

The first phase of the Western Newfoundland Model Forest (1992–1997) focussed on developing an Integrated Resource Management (IRM) Plan. The responsibility for developing values, goals and objectives for this plan fell to nine different Values Groups, with their findings reviewed periodically at plenary sessions comprising upwards of 40 people. When the Model Forest began its local level indicators initiative in 1997, every effort was made to build on what had already been learned and agreed to over the course of the development of the IRM Plan.

Initial purpose

In the five-year work plan completed in 1997, the Western Newfoundland Model Forest decided that its work on LLI would include the development of values, goals, indicators, objectives and specific practises. From the beginning, the decision was made to develop these elements in a parallel process, working simultaneously at the local scale as well as at the provincial scale. This is because it was recognized that there would be considerable overlap, and the Model Forest had the full support of the provincial government in taking the lead on certain aspects of the province's work on criteria and indicators (C&I).

As well, the Western Newfoundland Model Forest was interested in carrying out public and internal consultations to determine appropriate targets, thresholds, performance standards or objectives for each of the indicators; and to identify management practises necessary to meet the standards, consistent with the stated objectives of relevant frameworks such as the Canadian Standard's Association's Sustainable Forest Management guide and the Forest Stewardship Council's Principles and Criteria.



Western Newfoundland Model Forest Inc.

Criteria and Indicators of Sustainable Forest Management

A Practical Guide to Using Local Level Indicators in Newfoundland and Labrador

Western Newfoundland Model Forest Criteria and Indicators Steering Committee

April 1999

As the process evolved, there were three main products identified as the key deliverables of the Model Forest's LLI work:

a) a State of the Forest Report providing information on a range of indicators and updated regularly so as to assess trends;

b) an on-the-ground management plan that identified specific objectives and practises to be implemented in order to meet the various goals and objectives, with the local level indicators being used to assess performance; and

c) a practical guide and other materials that would assist in the LLI work being carried out in other forest management districts across the province and elsewhere.

EXPERIENCE GAINED — GETTING STARTED

The initial orientation workshop was tremendously valuable, since in one short afternoon it overcame the frustration that some people felt about having to adapt to a whole new set of concepts. Instead of "reinventing the wheel," the partners smoothly integrated their previous work with the then-new concepts of criteria of sustainable forest management.

Nevertheless, it is important to be patient, and to accept that it is an iterative process, which means that it will be necessary to go back and revisit past decisions on an ongoing basis.

It is useful to think strategically about the process, and to ensure that there is up-front involvement, buy-in and commitment from individuals and organizations that will be responsible for providing information on possible indicators, as well as from key decision makers. In order to do this it is crucial that each organization understands their interest and objectives with respect to local level indicators, and communicates this clearly to the model forest as a whole. This information is needed in order to be sure that the outputs will actually meet expectations (whether for a communications tool, performance standards, further research, certification, etc). Where certification is an objective then this must be discussed up front, so that model forest efforts conform with the requirements of the particular certification standard being sought.

Getting started on the work program

The Model Forest's work on C&I and local level indicators was guided by a Criteria and Indicators Steering Committee which included representatives from the provincial government, the pulp and paper industry, academia, and the Canadian Forest Service, with the participation of Model Forest staff. The committee was responsible for developing an annual work plan and overseeing its implementation. The bulk of the work of the committee was carried out under contract, although the committee members were intensively involved in discussing, refining and approving the indicators to be used.

The work got formally underway with a workshop in September 1997 attended by most of the Model Forest's partners. The half-day workshop assessed and validated the values and goals that had been developed over the previous five years in developing the IRM Plan, and assigned those values and goals to specific criteria from the set developed by the Canadian Council of Forest Ministers.

SELECTING INDICATORS

Initial indicators

A two-day workshop involving over 30 participants was held in October 1997. Participants broke into working groups according to each criterion, and identified potential indicators that could be used to measure how well the previously identified values and goals were being addressed. No formal attempt was made at this workshop to start from an existing set of indicators. Some participants were familiar with the CCFM indicators and introduced them into the discussions when helpful, but in general the participants felt free to work from a "blank slate." This resulted in some weak indicators being proposed but gave the participants a stronger feeling of ownership of the process.

INDICATOR SCREENING CRITERIA

1. Measurable
2. Predictable
3. Relevant
4. Understandable
5. Valid
6. Practical

Refining the indicators

The task of refining these indicators fell to the Criteria and Indicators Steering Committee which met regularly during the fall of 1997 to refine the outputs from both workshops into a manageable framework of values, goals and indicators. Each of the CCFM criteria were linked with 3–7 values, and each value was linked with 1–3 goal statements and 1–10 indicators. The result of these deliberations was released for comment and peer review in January 1998.

EXPERIENCE GAINED — SELECTING INDICATORS

One difficulty that was repeatedly encountered was the question of whether or not to include only quantitative indicators, or to also accept qualitative or descriptive indicators. To be used in a rigorous adaptive management planning process, including forecasting values for indicators, only quantitative indicators are useful. However, there are other uses for indicators, such as building understanding of and commitment to sustainable forest management, and in some cases descriptive indicators can be quite useful in this regard and more understandable than abstract numerical values. In the end, both types of indicators were used, but each indicator was specified as to whether it was quantitative or descriptive.

It is likely the case that very few indicators or sets of indicators "pass" all the screening criteria with flying colours. There are inevitably tradeoffs to be made between credibility and comprehensiveness on the one hand, and feasibility and practicality on the other.

Further Testing and Filling Gaps

Further review of these indicators took place sporadically over the spring and summer of 1998, with the C&I Steering Committee serving as the principal forum for discussion and decisions. The screening criteria used to assess indicators are included in the sidebar. As well, each indicator was described in terms of the scale at which it was relevant (local or stand, district or provincial). Many indicators were found to be relevant at several scales, but this needed to be specified clearly since this set of indicators was still intended to be used at both the district and provincial scales.

In addition to screening individual indicators, it was felt necessary to assess clusters or sets of indicators associated with a particular value. Two principles were used to assess sets of indicators.

a) **Credibility:** A good set of indicators should give a comprehensive and credible measurement of a particular value.

b) **Feasibility:** The task of gathering data for a set of indicators should be practical and feasible, considering realistic constraints on financial, human and technical resources.

A revised set of indicators was approved in the spring of 1999 and included in a "Practical Guide" that has since been published and distributed across the province. This set of indicators is quite large (with 83 quantitative and 27 descriptive indicators), and is intended to be used as a "shopping list" to be adapted and refined for specific purposes.

GATHERING DATA

Initial assessment

During the fall of 1998, the C&I Steering Committee developed a strategy for acquiring data on a select group of indicators. The challenge was to review the "long list" of indicators and to come up with a set that could be reported on as part of the Western Newfoundland Model Forest's first State of the Forest Report. In order to be useful, it had to be possible to report on each indicator with readily available information since the initiative had a budget only for data compilation and not for collecting new data. Every effort was made to ensure that there were sufficient indicators with enough breadth to give a meaningful picture of that indicator, including all of the values that had been associated with it.

Roles and responsibilities

Each indicator identified in the Data Acquisition Strategy was described according to the following characteristics:

- units of measure;
- lead person responsible for providing the information to the Model Forest;
- the source of the data;
- the scale;
- the measurement interval;
- an assessment of the data reliability; and
- a brief description of how that indicator will be interpreted to provide meaningful information related to sustainable forest management.

The responsibility for actually gathering the information from the lead agencies and for drafting the State of the Forest Report was assigned to a contractee.

OVERCOMING CHALLENGES IN DATA GATHERING

Data not available for the indicator selected. Substitute indicators can be used; for instance relative abundance or distribution maps to substitute for a lack of information about population levels of particular species.

Data not available at the spatial scale required. Some flexibility is needed regarding scale so that while the report focuses on the Model Forest area, some indicators are reported at a larger scale (e.g., marten distribution) and some at a smaller scale (e.g., water quality in a selected watershed).

Inconsistencies in temporal scale. It was felt preferable to report on the best, most accurate and up-to-date information available for each indicator rather than to try to ensure that all indicators reported on the same time period.

Technical challenges in merging different digitized data sets. This was a challenge when seeking to integrate the province's timber inventory with information available for Gros Morne National Park and has not yet been resolved.

Too much work, not enough staff time. Many indicators require intensive efforts from the agencies collecting the data simply in order to provide it to the Model Forest in a useful format. It is important to show how everyone gains when this information is more widely disseminated and understood as a result of the Model Forest's work.

Data "hoarding." Some agencies or individuals can be reluctant to share information due to concerns about how it will be used. This can be addressed by providing drafts to the agencies supplying the data for their review and approval.

Practical limitations to interpretation. There are almost always limitations to indicators due to small sample sizes, inconsistent collection protocols, insufficient data to identify long-term trends, "noisy" data that is influenced by a variety of factors, etc. Rather than seeing this as an obstacle that needs to be overcome with further research, it can be helpful to acknowledge that the very complexity of sustainable forest management makes this an inevitable factor. Caution is needed in making firm interpretations of the data, but it is nevertheless possible to show interrelationships.

Interpreting "negative" trends. Agencies are reluctant to release information that they fear will reflect negatively on their activities. This is not an easy concern to deal with, but it can be lessened somewhat by being cautious in interpreting data, either positively or negatively.

It is important to ensure that there is continued ownership of the process. During the data gathering phase the work will be carried out by a small group of people with specific tasks to do, and there is a risk of losing touch with the larger stakeholder community. Regular updates should be provided in order to keep the larger constituency informed on an ongoing basis.

Current status

A preliminary draft State of the Forest Report has been prepared, although there are still several gaps in it that are currently being addressed.

Ongoing monitoring

Since the Model Forest's first State of the Forest Report is based largely on existing data, the ongoing responsibility for monitoring resides with the agency that supplied the information. A significant exception is that a number of the indicators under Criteria 5 and 6 were derived from a survey commissioned by the Western Newfoundland Model Forest which polled respondents both on the uses they make of the forest, their sources of information about forest management and their attitudes about sustainable forest management. It is the intent of the Model Forest to repeat this survey in a few years, allowing for a comparison of results and the identification of preliminary trends.

USING AND REPORTING ON INDICATORS

Indicators in management planning: The Western Newfoundland Model Forest is not responsible for management planning as such, but is in the process of identifying a set of objectives that would implement the goals that have been identified, as well as setting target levels for specific indicators. This work was begun at a two-day workshop in May 1998, with a follow-up three-day workshop in October 1998.

Forest certification: Both forestry companies involved in the Western Newfoundland Model Forest, as well as the provincial government, are pursuing certification at some level, with Abitibi-Consolidated announcing its successful registration under ISO 14001 in the spring 2000. Although the Model Forest is not directly involved in these initiatives, its work on local level indicators is helping to focus efforts on practical approaches to monitoring implementation of sustainable forest management plans.

State of the Forest Report: The Western Newfoundland's first State of the Forest Report is nearing completion and will report on 20 indicators, supplemented by three case studies.

Communications: The Model Forest published a seven-part series of newspaper articles explaining criteria and indicators and their relationship with sustainable forest management. This series was adapted from a set of articles originally prepared by the Lake Abitibi Model Forest.

NEXT STEPS

Activities to be pursued in the coming year include the following:

- developing a Biodiversity Assessment Tool (i.e., a computer model) to develop a 'better' suite of biological indicators;
- in cooperation with Fundy Model Forest, propose a cooperative project with the Canadian Forest Inventory Committee and the Model Forest Network to develop indicators that are useful at the local, regional and national scales; and
- continue to develop and carry out projects that will improve the Model Forest's suite of indicators over time, putting the partners in a stronger position to advance sustainable forest management.

Publications and Reports

Anonymous. 1998. *A Non-Technical Look at Criteria and Indicators of Sustainable Forest Management.* WNMF, seven 1-pg articles.

von Mirbach, Martin. January 1998. *Sustainable Forest Management: Criteria and Indicators for Newfoundland (Discussion Draft).* WNMF, 27 pgs.

Moores, Len, Martin von Mirbach and Sean Dolter. October 1998. *Defining Objectives for Sustainable Forest Management.* WNMF, 19 pgs.

von Mirbach, Martin. April 1999. *Criteria and Indicators of Sustainable Forest Management: a Practical Guide to Using Criteria and Indicators in Newfoundland and Labrador.* WNMF, 38 pgs.

von Mirbach, Martin. February 2000. *Reporting on Local Level Indicators: Barriers and Solutions.* WNMF, 10 pgs.

Western Newfoundland Model Forest State of the Forest Report. WNMF, forthcoming.

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TABLE 3.2: LOCAL LEVEL INDICATORS OF THE WESTERN NEWFOUNDLAND MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area of each forest type, by age class	Hectares	WNMF	5 yrs	DFRA; GMNP	•good opportunities for forecasting •to be completed
Protected areas	•Proportion of each ecosystem sub-region that is in a protected status •Proportion of each sub-region that is barren, bog, forest and water •Proportion of each protected area that is barren, bog, forest and water	WNMF	Updated as protected areas are formed or removed	DFRA; GMNP	•to be completed
Forest fragmentation	Maps outlining roads	WNMF	5 yrs	DFRA	•done
Population levels of caribou	Population estimates	WNMF	Irregular & dictated by the Wildlife Div.	DFRA	•two census surveys have been done for each of two distinct herds
Distribution of Newfoundland marten	Distribution map based on available habitat	Defined study areas & Island	Irregular; 4 stages (1500–1997)	DFRA Inland Fish & Wildlife	•to be digitized

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area of insect, fire and logging disturbance	Hectares	District 14, 15, 16	Annually	DFRA Inventory Data	•done
Species interrelationships	Relative abundance of snowshoe hare and lynx on the island	WNMF, Island	Annually	Wildlife Division; DFRA	•done

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Ground disturbance as a result of logging operations	Percent of ground disturbance by logging method and season	Island	5 yrs	DFRA study	•info gathered yearly 1990–1995 and again in 1999 to assess change
Water quality	Nitrogen levels and total suspended sediments	WNMF	Annually	Copper Lake Study	•done
Drinking water quality	Levels of Giardiasis outbreak	WNMF, Island	Annually	Municipalities within WNMF; Western Memorial Regional Hospital	•cases compared against the national level. •done
Forest policy	Status of 5 yr plans and amendments	District 14, 15, 16	Annual	DFRA	•done

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Currently no indicators being measured for this criterion

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Timber usage	Cubic metres, by end use	District	Annual	District Offices	•done
Employment in the forest industries	•# of employees, •# of person-years •weekly earnings	Island	Annual	DFRA; Statistics Canada	•done
Outfitting revenue	Direct revenue and expenditures	Island	Annual	Dept. of Tourism and Culture	•1994 figures available

continued on the next page

Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Usage of forest access roads	Percentage of survey respondents using forest access roads for a specific purpose	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete
Domestic use of products from the forest	Percentage of survey respondents using forest products on a domestic level	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent of public involvement in forestry issues	Percentage of survey respondents that expressed their views on forest management	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete
Level of satisfaction with how forestry concerns have been addressed	Percentage of survey respondents that demonstrated a certain level of satisfaction	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete
Sources of information on forestry issues	Percentage of survey respondents that use various sources of information on forestry issues	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete
Awareness about the Western Newfoundland Model Forest	Percentage of survey respondents who have heard of the WNMF and feel that the WNMF contributed to their knowledge of SFM	WNMF	3 yrs	WNMF Attitudinal Survey	• 1st survey complete

ABBREVIATIONS
DFRA: Department of Forest Resources and Agrifoods
GMNP: Gros Morne National Park
WNMF: Western Newfoundland Model Forest

The Nova Forest Alliance ... has been chosen as the first site to test sustainable forest management concepts developed in another Model Forest.

Nova Forest Alliance

NOVA FOREST ALLIANCE

BACKGROUND

The Nova Forest Alliance (NFA), Nova Scotia's Model Forest Project, is located in central Nova Scotia, bordered by Halifax, Windsor and Truro. It encompasses 458,000 hectares of land, representing 8% of the land base of Nova Scotia. Its 45 diverse partners represent government, industry, private landowners, universities, environmental, and other interest groups.

The Nova Forest Alliance plays a unique role in the Canadian Model Forest Network. It has been chosen as the first site to test sustainable forest management concepts developed in another Model Forest — the Fundy Model Forest — which shares information with the Nova Forest Alliance. The Nova Forest Alliance joined the Canadian Model Forest Network in 1998.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

The information in this section has been largely drawn from a Status Report prepared in March 2000. That report, which has considerable additional detail, is available from the Nova Forest Alliance.

Prior activities

The Nova Forest Alliance is a recently created agency and did not have a wealth of prior experience to call upon. However, several of the partners had prior experience with the use of criteria and indicators and the NFA has been able to benefit from its close association with the Fundy Model Forest to take advantage of the wealth of experience gained by that Model Forest.

Initial purpose

It was agreed from the outset that the work being carried out by the Nova Forest Alliance should have application beyond its own boundaries. The knowledge gained would be most useful if it could be applied to forestry company initiatives as well as provincial reporting schemes. Those partners interested in forest certification, for instance, would be able to make use of the results from the Nova Forest Alliance process and adopt those indicators in their own certification or registration programs. In addition, it was recognized from the outset that Nova Forest Alliance's process must be participatory and inclusive of all partners, and that it must include local values and goals in its framework.

Getting started on the work program

The criteria and indicator process began in October 1998. Below are some of the key steps taken at each of the first five meetings:

Meeting #1 (October 1998): Agreement reached to build on the national process and to adopt the approach developed by the Canadian Council of Forest Ministers; in particular, the framework of six criteria.

Meeting #2 (January 1999): Agreement to seek to develop a relatively small suite of indicators, in order to simplify monitoring, reporting and communication.

Meeting #3 (February 1999): Agreement that the Nova Forest Alliance partners would be the principle decision makers on the indicators, with the general public polled on their values, and scientific expertise brought in to help out where required.

Meeting #4 (March 1999): A discussion of several specific projects with some relevance to the local level indicators initiative — the Ecosystem Classification project, the Genuine Progress Index, and the Fisher study. A side meeting in late March amongst the industry and provincial partners firmed up their commitment to the Nova Forest Alliance's LLI process and to produce a State of the Forest Report for the NFA.

Meeting #5 (May 1999): The committee developed a work plan for the LLI process aiming at developing a set of indicators by the end of the year and testing them in 2000.

Support for these activities were provided by the Nova Forest Alliance's General Manager and Communications Officer, as well as term employees when available.

LESSONS LEARNED — GETTING STARTED

- It is crucial that there be a clear picture of what the end product will be in order to keep various working groups focussed on the outcome.
- While the accountability for specific tasks can be assigned to individual team members, it is nevertheless important for the entire team to be kept current on all aspects of the local level indicators initiative.
- There needs to be significant administrative support provided in the early stages of the initiative — preparation of minutes and other documentation, as well as follow-up on specific projects.

SELECTING INDICATORS

Initial indicators

Meeting #6 (June 1999): This was a major workshop involving a larger attendance of partners. The CCFM criteria were reviewed and, after some discussion, adopted. Three working groups were formed with each group given the task of developing elements and indicators for two of the criteria.

INDICATOR SCREENING CRITERIA

1. Measurable
2. Practical
3. Understandable
4. Relevant
5. Specific
6. Meaningful in decision-making
7. Sensitive to change
8. Response-oriented
9. Predictable
10. Positive

Meeting #7 (July 1999): The committee reviewed numerous sets of indicators, but in the end decided to use the set from Fundy Model Forest as a starting point. It was decided to hire a student to compile a matrix of all indicator sets in order to provide an overview to the committee.

Refining the Indicators

Meeting #8 (September 1999): Each of the working groups formed at the June workshop reported on their progress, and the committee as a whole had extensive discussion of their findings. They had evaluated the indicators against the ten criteria listed in the sidebar.

Meeting #9 (October 1999): Continued the discussions begun at the previous meeting. A decision was made to hold another large workshop to discuss a near-final set of indicators and to get solid buy-in to that set before investing resources into testing.

Meeting #10 (December 1999): At this workshop participants had the opportunity to rank the proposed indicators according to the degree they were: a) relevant to sustainable forest management, b) practical, and c) understandable. Groups were pressed to be diligent in selecting a small group of indicators while ensuring that there is at least one indicator per element within each criterion. A core set of 36 indicators was established as priority indicators. The others will be pursued at a later date, pending time and resources.

Further testing and filling gaps

Meeting #11 (March 2000): The team leaders met to discuss the next steps for the local level indicators process. It was agreed that the teams would meet and decide on the final descriptions of the indicators, assign responsibilities to team members for the indicators, and identify any resource requirements. Late June was set for a meeting to discuss progress and a meeting at the end of September to submit testing results in a draft report on the LLI. In terms of core support, it was agreed that the LLI budget for the coming year needs to incorporate some base funding for a GIS analyst's time, and a Local Level Indicators co-ordinator to facilitate the teams.

GATHERING DATA

Initial Assessment

The Nova Forest Alliance relied in the first instance on the provincial forest inventory from 1992 which was updated in 1999. This information was supplemented with baseline data collected in the summer of 1999, especially pertaining to ecological land classification for the region. As well, the Nova Forest Alliance commissioned a public survey in order to obtain a "baseline" assessment of people's views and attitudes about forests and forest management.

LESSONS LEARNED — SELECTING INDICATORS

- Much of the indicator selection process centred around getting a common understanding of the meaning of the indicator and its usefulness in reporting on sustainable forest management. Adequate time needs to be allocated for discussions that can be complex at times.
- Keeping momentum is a challenge. Team leaders are critical to keep the process on track, punctuated by periodic team leader meetings. These efforts, however, must be supplemented by core support in several key areas: overall coordination, GIS needs and data collection.
- It is to be expected that discussion of indicators (and gaps in indicators) will lead to a need for further research.

Roles and Responsibilities

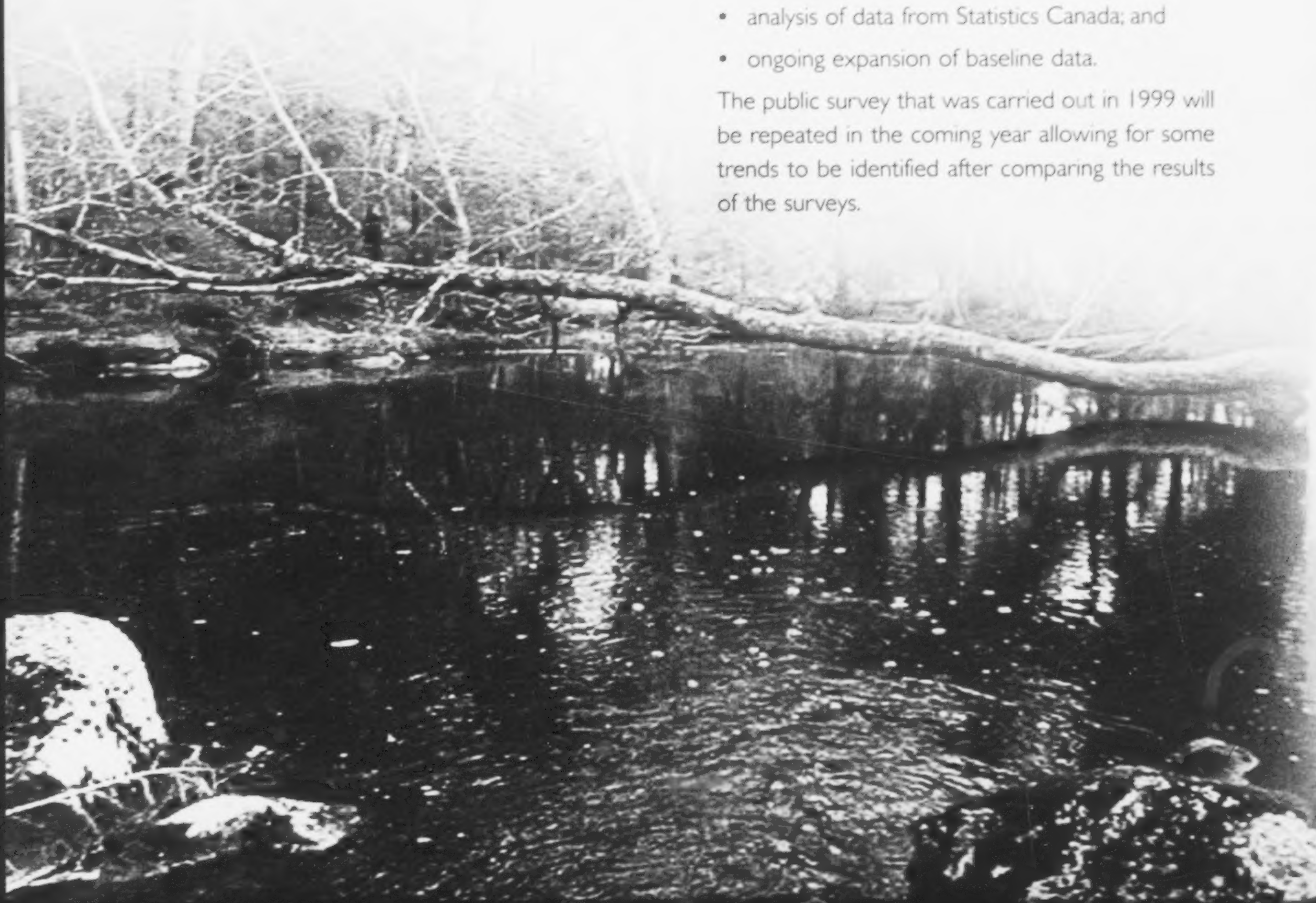
Eight teams have been assembled to work further with the selected indicators with each team concentrating on a manageable cluster of indicators (from 2–7 indicators each). This allows for peoples' energies to be more efficiently focussed on their particular areas of interest and experience. These teams are relying on volunteer commitments of team members to complete their tasks.

Current Status

Information about local level indicators is currently being collected through the following means:

- analysis of the findings from the public opinion survey;
- update of GIS coverage of the area;
- compilation of data generated by various research projects being carried out with the support or participation of the Nova Forest Alliance;
- analysis of data from Statistics Canada; and
- ongoing expansion of baseline data.

The public survey that was carried out in 1999 will be repeated in the coming year allowing for some trends to be identified after comparing the results of the surveys.



Ongoing Monitoring

Data gathering is currently getting underway as the Nova Forest Alliance's first State of the Forest Report is in the process of being compiled. After this has been completed, the partnership will identify guidelines for future reports and will identify ongoing monitoring responsibilities.

USING AND REPORTING ON INDICATORS

State of the Forest Report: The Nova Forest Alliance is currently working towards completion of its first State of the Forest Report. The report is to contain what is happening in the forests today or the 'baseline' information, and will not seek to identify trends. Two target audiences were defined, the first was the technical audience and the second was the general public. It was agreed that the C&I committee would strive to have the technical report available for the indicators by the end of 2000. The public State of the Forest Report would follow in early 2001.

Scenario development: The Nova Forest Alliance has established a second stage to its local level indicators work by establishing a sustainable forest management planning process which will use a set of indicators to develop a range of future scenarios based on community input.

Stimulate discussion and dialogue: This has been central to all of the work on local level indicators carried out by the Nova Forest Alliance. In the initial stages the discussions took place within the teams that were established to get the job done, as well as at larger workshops at which a broad range of interests were invited. These discussions are expected to continue and intensify during the process of selecting desired scenarios. As well, it is anticipated that the State of the Forest Report will be widely distributed within the region and will stimulate discussions as well.

NEXT STEPS

The immediate priority steps are to carry out an initial measurement of all core indicators, complete the Nova Forest Alliance's first State of the Forest Report, and begin the process of generating visions of the future forest.

Publications and Reports

- Nova Forest Alliance. March 2000. *Criteria and Indicators Status Report*. 17 pgs.
- Nova Forest Alliance. undated. Local Level Indicators for Nova Forest Alliance (list). 1 pg.

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TABLE 3.3: LOCAL LEVEL INDICATORS OF THE NOVA FOREST ALLIANCE

Criterion 1: Conservation of Biological Diversity

Indicator	Interval	Source of Data	Comments Current Status
Total forest area by percent and extent in all the combinations of forest cover types and maturity classes.	—	GIS coverages	•Process has begun
Area of forest permanently converted to non-forest land use, e.g., urbanization. Also includes agriculture and golf courses	—	GIS coverages	•Process has begun
Number of known forest-dependant species classified as endangered to vulnerable and the number of recovery plans for these species	—	COSEWIC and NS tables, GIS	•Process has begun
Area of habitat suitable and available for selected species and/or species guilds	—	Theme Regions, field work?	•Process has begun
Amount of area with natural cover type suited to the Acadian Forest Region and Site	—	Ecological reserves data, GIS	•Process has begun

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Interval	Source of Data	Comments Current Status
Climate indices: (pH and amount of precipitation)	—	Unknown	•Group has not met
Area and type of human disturbances specific to forest harvesting	—	Unknown	•Group has not met
Percent and extent of forest cover types and maturity classes	—	Unknown	•Group has not met
Percent of area meeting expected growth targets for site type	—	Unknown	•Group has not met
Growing stock by forest cover type	—	Unknown	•Group has not met

Criterion 3: Conservation of Soil and Water Resources

Indicator	Interval	Source of Data	Comments Current Status
Extent of harvest area with significant soil disturbance	—	Unknown	•Group has not met
Percentage of watershed area in a recent cut condition	—	Unknown	•Group has not met
Percentage of forest managed under BMP's and other guidelines	—	Unknown	•Group has not met
Percentage of riparian zones meeting specifications	—	Unknown	•Group has not met
Percentage of stream crossings constructed and maintained to standard	—	Unknown	•Group has not met

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Currently no indicators being measured for this criterion

Criterion 5: Multiple Benefits to Society

Indicator	Interval	Source of Data	Comments Current Status
Annual removal of forest products	—	Unknown	•Group has not met
Landbase available for production of forest products	—	Unknown	•Group has not met
Volume of merchantable wood left on site after harvest	—	Unknown	•Group has not met
Annual volume of forest by-products and waste	—	Unknown	•Group has not met
Contributions to Gross Provincial Product by specific timber and non-timber sectors	—	Unknown	•Group has not met
Employment in specific timber and non-timber sectors	—	Unknown	•Group has not met
Use of forests for non-market goods and services	—	Unknown	•Group has not met
Area and # of special forest places	—	Unknown	•Process has begun
Landscape visual aesthetic appeal	—	Survey, Forest landscape design?	•Process has begun
Density/Quality/Diversity of interpretative trails	—	Unknown	•Process has begun
Quantity of litter/garbage collected	Yearly	Reports	•Process has begun
Satisfaction levels of users with forest recreation opportunities	Yearly	Survey	•Process has begun

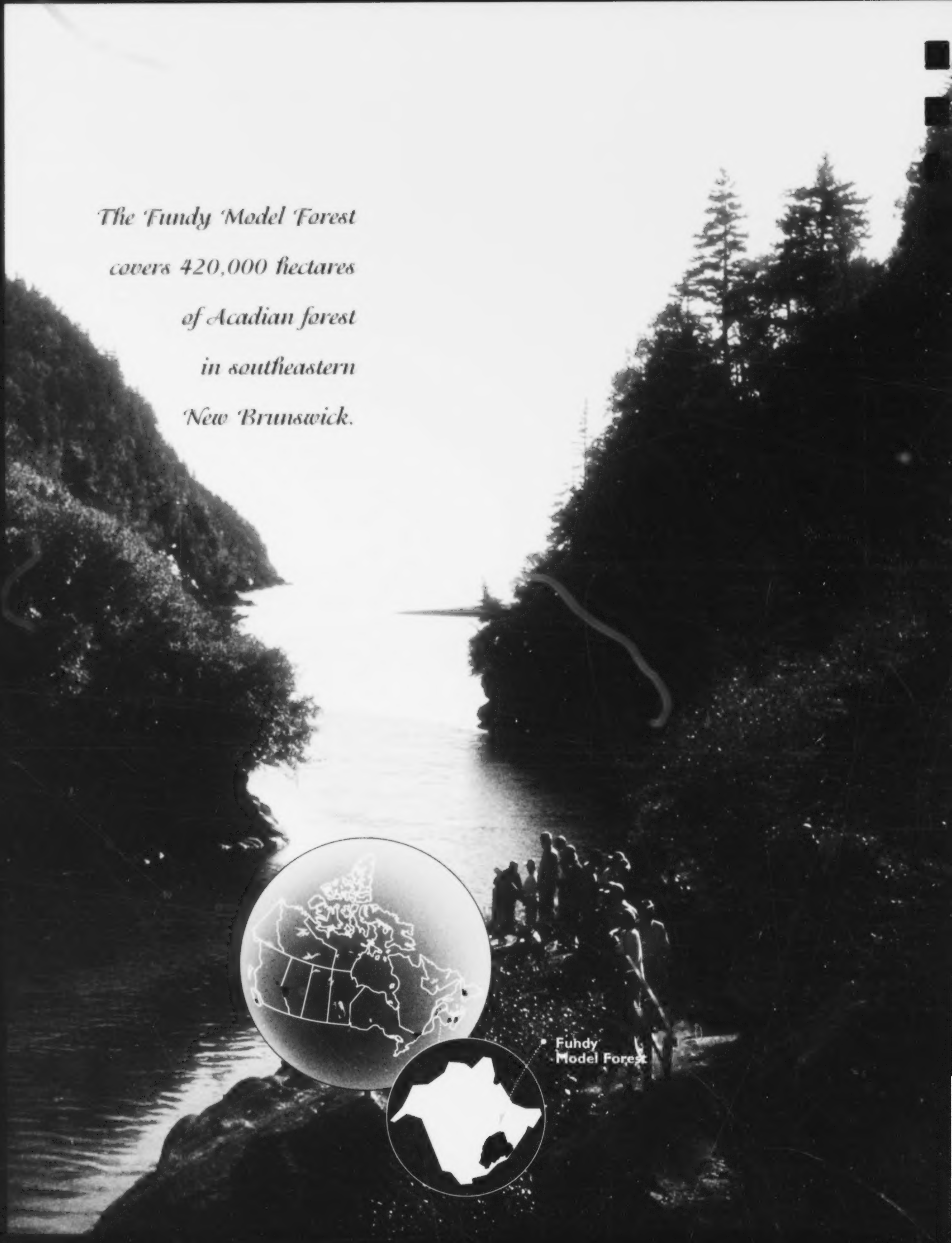
Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Interval	Source of Data	Comments Current Status
Degree of involvement of Mi'kmaq and/ or Aboriginal people in SFM process	—	Unknown	•Group has not met
Level of understanding of all parties involved in SFM of Mi'kmaq issues	—	Unknown	•Group has not met
Percent of households with forest based employment full or part time	—	Census data, APEC report	•Process has begun
Number of communities (households) with a significant forestry component to their economic base	—	Census data	•Process has begun
"Index of diversity" of local industrial base with significant forest economic base	—	Census data	•Process has begun
Degree of public participation in SFM process	—	Public Survey	•Process has begun
Investments in forest related research and technology transfer	—	Survey	•Process has begun
Percentage of forest area under SFM plans	—	GIS coverages	•Process has begun
Degree of public is knowledgable of SFM	—	Public Survey	•Process has begun

NOTE: •Unknown refers to unknown at this time
•Spaces left blank refer to teams not at that level yet or not discussed yet.

ABBREVIATIONS
APEC: Atlantic Provinces Economic Council
BMP: Best Management Practices
COSEWIC: Committee on the Status of Endangered Wildlife in Canada

The Fundy Model Forest covers 420,000 hectares of Acadian forest in southeastern New Brunswick.


Fundy Model Forest

FUNDY MODEL FOREST

BACKGROUND

The Fundy Model Forest covers 420,000 hectares of Acadian forest in southeastern New Brunswick. Located between three of the province's largest cities (Saint John, Moncton and Fredericton), this working forest includes towns and villages, industrial freehold land, Crown and private land, as well as Fundy National Park.

Most of the land is privately owned, with 3,500 woodlot owners in the area. That is, 63% of Fundy Model Forest consists of private woodlots, almost 15% is Crown land, 17% is industrial freehold land owned by J.D. Irving, Limited, and 5% is Fundy National Park.

Fundy Model Forest represents a partnership between the federal and provincial governments, the forest industry, private woodlot and other land owners, scientific and educational associations, environmental groups, and recreational organizations. In all, this partnership is made up of 31 groups. Fundy Model Forest is managed by a Partnership Committee and a Management Committee while six working groups guide the variety of projects that reflect the complexities of the forest.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

During the first phase of the Model Forest Program (1992–1997) the Fundy Model Forest's organizational structure consisted of eight technical committees dealing with recreation, wood supply, biodiversity, soil, water, socio-economic issues, communication/public participation, and consumptive fish and wildlife use. Representation on the technical committees was derived from within the Fundy Model Forest partnership.

Initial purpose

The Fundy Model Forest's original intent in using local level indicators was to establish baselines for specific forest values and to monitor the status of those values across the multiple ownership land base.

Getting started on the work program

At the advent of Phase II of the Program (1997–2002), the technical committees were reorganized into Local Level Indicator Working Groups to address each of the six criteria established by the Canadian Council of Forest Ministers, and a seventh to deal with the management planning implications. The working groups were designed to be open committees and an invitation was sent to all partners inviting them to participate in one or more working groups. They were chaired by representatives from a variety of partner organizations (University of New Brunswick, New Brunswick Department of Environment, Canadian Forest Service and Fundy National Park). They met on numerous occasions, as well as sharing information on an ongoing basis by electronic means.

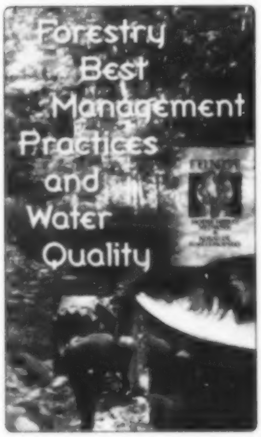
EXPERIENCE GAINED — GETTING STARTED

The Fundy Model Forest found that there is sufficient information for any group to develop indicators. The more challenging tasks are to ensure that the indicators reflect local values and to set management objective levels for the specific indicators. Many of the CCFM indicators were lacking functionality due to a lack of standards and protocols for monitoring and reporting, so that many projects undertaken by the Fundy Model Forest were aimed at establishing those standards.

SELECTING INDICATORS

Initial indicators

The Fundy Model Forest used the CCFM's framework of criteria, critical elements and indicators as a starting point for its work on local level indicators. The Partnership and Management Committees reviewed the six criteria and approved all of them for use in Fundy with some wording changes. The LLI Working Groups reviewed and approved 18 of the 23 "critical elements" (or sub-criteria) proposed by the CCFM, and accepted the CCFM's 83 indicators as a starting point for developing a set of indicators for the Fundy Model Forest.



Pratiques
de gestion
optimales en
foresterie
et
qualité
de l'eau

Refining the indicators

The working groups then reviewed the CCFM's 83 indicators in some detail, using the criteria listed in the sidebar. Based on this assessment, the indicators were listed in one of the following categories:

- **Functional**: there is sufficient information at hand to use this indicator;
- **Semi-functional**: the databases required are not currently available, but could be obtained; or
- **Non-functional**: the indicator cannot be used because it's not appropriate at the Fundy Model Forest scale, or is influenced by factors outside the control of the Model Forest, or the tools and technologies are not available for monitoring.

INDICATOR SCREENING CRITERIA

1. Is it justifiable towards achieving Fundy's goals?
2. Does it require a national strategy?
3. Is it measurable?
4. Is data available?
5. Do we presently have quantifiable objectives?
6. Can it be used in forecasting models?

At least one functional indicator was identified for each critical element, and several workshops were held to review the selected indicators. As a result of this process, 53 functional or semi-functional indicators were selected.

The review process took the better part of a year (1997–1998), with approximately 800 person hours devoted to the many meetings that were required. The suite is still considered a living document since with more information and experience the context and intent of Fundy's local level indicators initiative continues to develop. The group responsible for socio-economic indicators under Criterion 5 (Multiple Benefits from Forests), for instance, is currently going through a significant modification of their indicators.

Further testing and filling gaps

Of the 53 indicators selected through the process described above, only 14 of them were identified as being forcastable on a spatial scale. These were passed on to the Management Planning Working Group to use in scenario planning and other management exercises. All of the approved indicators (i.e., the set of 53) were further reviewed by the LLI Working Groups to define in greater detail specifically how they relate to forest management, sustainability issues and forest values, goals and objectives.

Most of the Fundy Model Forest's current projects relate to some aspect of local level indicators, whether to fill gaps in the indicators, to collect specific data, or to promote demonstration and technology transfer. Databases are being collected through research projects, from existing sources outside the FMF, and from the partners with land management responsibility.

EXPERIENCE GAINED — SELECTING INDICATORS

The Fundy Model Forest has found that some indicators are not affordable by either the Model Forest or the landowners. These are best left to provincial and federal agencies. Examples include indicators dealing with atmospheric inputs, and some socio-economic indicators.

GATHERING DATA

Initial assessment

The indicators identified as functional or semi-functional were then assessed for the data sources available to measure the indicator. Problems requiring further attention were flagged either to gather new data or to resolve compatibility issues

Roles and responsibilities

Two GIS/database staff were assigned to work with the committees to collect, analyse and collate databases for each of the indicators. Progress is reported back to the committees and the partnership. The communications person worked with the database staff, the committees, and researchers to develop information materials for transfer to the partnership and the public at large.

Current status

A Status Report was completed in October 1999 listing the following information for each indicator:

- the management planning objective associated with the indicator;
- progress to date in using the indicator;
- expected progress in the coming months;
- development needed;
- monitoring responsibility;
- monitoring period review;
- functionality;
- reporting level (scale);
- protocols and standards;
- Greater Fundy Ecosystem guidelines for implementation; and
- an estimate of completeness.

Each indicator is to be monitored by the responsible agency at the time interval specified, with the results evaluated by the technical working groups and the Partnership as a whole to assess the trends and to determine if adjustments are required to the planning process.

Ongoing monitoring

It is expected that the Fundy Model Forest will be the repository for the consolidated information on the full range of indicators, although the information itself will in many cases be provided by partner organizations. At this time, the Model Forest does not have a specific plan to assume responsibility for ongoing monitoring.The intention is to develop the processes, report in the State of the Forest Report, and recommend to the land owners the process for reporting.

USING AND REPORTING ON INDICATORS

Forest management: From the outset the Fundy Model Forest's LLI initiative was based on relating the indicators to specific management goals and objectives which were defined and refined throughout the indicator selection process. The land managers are incorporating the values identified by the indicators; however, a formal monitoring strategy is not involved.

Best Management Practises: Each indicator was given a functional management level based on the desired or sustainable levels. These were then reviewed by the landowners and after further discussion a set of implementable Best Management Practises were identified. This process will receive more attention in the coming year as databases are compiled.

Scenario planning: Scenario planning was used to develop a consensus-based, multi-stakeholder management planning process for a case study area comprising 114,000 hectares in the eastern Fundy Model Forest area. Public consultation and partnership input were used to define 25 different scenarios to determine the effects of various means of riparian strip management, road construction, vegetation and insect control, harvesting, maintenance of biodiversity and plantation establishment. The Woodstock forest modelling software was used to determine the effects of each scenario on timber supply, forest structure, measures of biodiversity and ecological integrity, areas of mature forest, and wildlife habitat. In a series of workshops, the Partners were successful in reaching consensus on a Fundy Model Forest "preferred" management scenario, which was conveyed to the land managers for implementation. The process is described in greater detail in a report (MacLean et al, undated).

State of the Forest Report: Model Forest staff, together with committee members and researchers, are working to develop a "State of the Forest Report" which will gather and report on the full set of 53 indicators approved for the Fundy Model Forest. This report is scheduled for completion by the end of Phase II of the Fundy Model Forest, in early 2002.

Certification: The Fundy Model Forest is working to ensure that its activities in developing, measuring and reporting on local level indicators is of benefit to partners who are pursuing various forms of forest certification. The Southern New Brunswick Forest Products Marketing Board is working towards certification under the Canadian Standards Association's SFM process. It has collaborated with the Model Forest in identifying indicators and expects to be able to make good use of the databases developed by the Model Forest. J.D. Irving, Limited is pursuing certification under the Forest Stewardship Council and ISO, and is using information from the Fundy Model Forest on management planning processes as well as measures to protect biodiversity and ecological indicators.

EXPERIENCE GAINED — USING INDICATORS

Application of local level indicators continues to be hampered by a lack of both scientific knowledge as well as adequate standards and protocols. Another difficulty that has become evident is the lack of integration of indicators within a criterion as well as integration between criteria.

NEXT STEPS

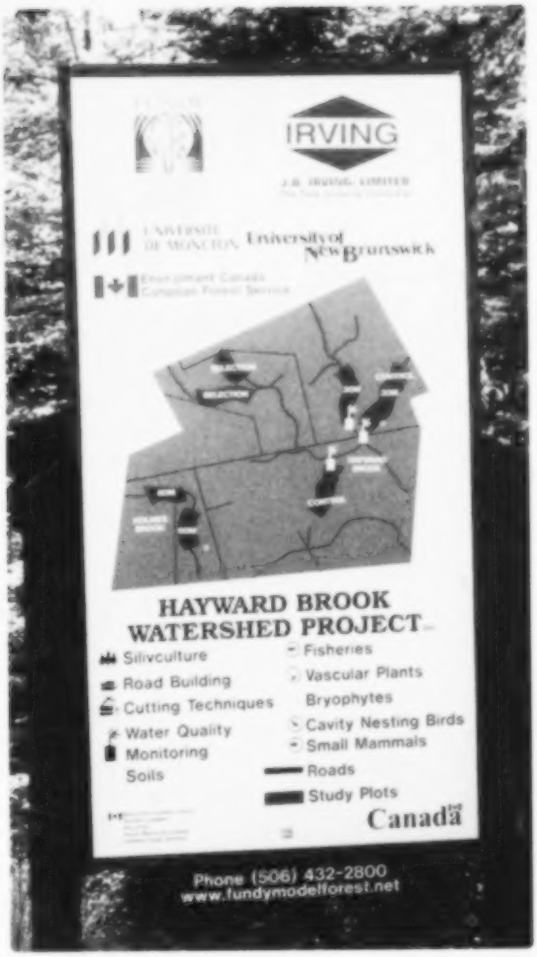
The Fundy Model Forest's priority activities in the coming year are to:

a) collate information and databases into the State of the Forest Report;

b) continue development of a relevant set of Best Management Practises;

c) develop a set of recommendations for land managers and policy makers relative to the State of the Forest Report; and

d) continue to evolve methods for monitoring and reporting.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www.fundymodelforest.net

Publications and reports

- Etheridge, Peter and Edouard Daigle (ed.). undated. *Local Level Indicators Development Process for the Fundy Model Forest*. Fundy Model Forest, 14 pgs.
- Etheridge, Peter, Kevin Pugh, Glen Watt and Maureen Whelan. October 1999. *Criteria & Indicator Status Report 1999/2000*. Fundy Model Forest, 70 pgs.
- Fundy Model Forest. undated. Development of Local Level Indicators: The Process. 5 pgs.
- MacLean, David A., Peter Etheridge, Joe Pelham and Walter Emrich. undated. *Fundy Model Forest: Partners in Sustainable Forest Management*. Fundy Model Forest, 19 pgs.
- Woodley, S. and G. Forbes (eds.). January 1997. *Forest Management Guidelines to Protect Native Biodiversity in the Fundy Model Forest*. 44 pgs.

Further information

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TABLE 3.4: LOCAL LEVEL INDICATORS OF THE FUNDY MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percentage and extent in area of forest community and age class by ELC, relative to pre-European settlement condition and total forest area	Area in hectares Age class?	Eco-region	5 yrs	DNRE	•Measured to the defined forest area of each landowner (JDI, SNB, Crown & FNP)
Percent and representativeness of protected areas within the site district(s) of which the unit is a part	Area in hectares of forest community group by IUCN class	Model Forest	10 yrs	DNRE, JDI, FMF, FNP, DOE, CWS, etc	•Measuring current state for baseline
Level of forest fragmentation and connectedness of forest ecosystem components	km of road / km^2 of area	Model Forest	5 yrs	GFERG & Stephen Woodley	•Current research addressing other issues
Number of species classified as extinct, extirpated, endangered, threatened or vulnerable	List of targeted species for FMF	Model Forest	5 yr review; 3 yr for rare/ extirpated	COSEWIC & FMF (CFS Rep. # MX 198E) NB Museum Clayetal 1984 & G.Forbes/UNB Rare Plants Hinds 1983 NB Comm. on Endangered Species	
Population levels/indices of selected species or guilds	Area in hectares of habitat	Model Forest	5 yrs	SNB & JDI wood supply analysis	•Crown, FNP
Habitat quality and quantity for selected species	—	—	—	—	—
Number of known forest-dependent species that occupy only a small portion of the former range in the region	—	DFA	5 yrs	FMF & UNB	•Strategies for those species in trouble
Implementation of an ex-situ/in-situ gene conservation strategy	—	DFA	5 yrs	FMF	—
Changes in population, genetic diversity and structure and gene flow for selected species	—	DFA	5 yrs	FMF	—

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area and severity of insect infestations	ha/yr & m^3/ha	FMF	Annual	FMF/ Province	•Past volume losses & anticipated volume loss
Levels of disease outbreaks	—	FMF	Annual	FMF/ Province	—
Area and frequency distribution of fire damage	# fires/yr & size in ha	FMF	Annual	FMF	•List all fires by class & severity
Area and type of human disturbances specific to forest harvesting	Area (ha)	DFA	Annual	SNB	•List planned harvest activities by eco-region for next 25 years
Level and extent of active pest control operations	Area by product type	DFA	5 yrs	FMF & DNRE	•SBWDSS product for FMF area by CFS
Percentage and extent of area by ecological community type and age class.	Area by harvest type for 80 yrs	Eco-region	5 yrs	FMF	•Report to define forest area of all major landowners
Percent of attempted natural and artificial regeneration which was successful	Area by plant vs. non-plant 80 yrs	Eco-region	5 yrs	DNRE & JDI	—
Mean annual increment and current annual increment by forest type and age class	Growth curves	Eco-region; DFA	5 yrs	FMF & DNRE	•Report will include measured MAI to modelled MAI

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Changes in soil pools of available nutrients in recently harvested areas	—	—	—	—	—
Chemical and physical structure of soil (pre- and post-harvesting) on representative ecosites	Area Affected	FMF	?	Research Plots	•2000 - 2001 study extrapolated to rest of FMF
Changes in landuse patterns, by individual watersheds, that have an impact on water quality	Area by broad and specific landuse type	FMF	10 yrs and/ or 1 yr	FMF & DNRE	—
Adherence to Canadian water quality guidelines. (aquatic, drinking, recreation, agriculture, and industry)	Various chemical & physical parameters benthic invertebrates	Watersheds	?	FMF & DNRE	—
Status of riparian zones within the forest across the landscape	% forest vs non-forest	Watersheds	10 yrs	FMF & DNRE	•Reported for all watersheds in the FMF
Degree of implementation of Guidelines for Soil and Water Protection (ex: Clean Water Act, guidelines for Crown Land, BMP's, Pesticides /Petroleum); use of machinery adjacent to water/buffers; guidelines for soil, BMP's for rutting	Outlined by the various Acts & Regulations	Watersheds	—	FMF	•Need to determine the standards & protocols for water quality monitoring
Implementation of Guidelines for Forest Class Road and Crossing Construction and Maintenance	—	Watersheds	3 yrs	DNRE	—

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Tree biomass volumes	m^3	Eco-region	10 yrs	SNB	—
Vegetation (non-tree) biomass estimates	m^3	Eco-region	upon availability	SNB	•Need preliminary investigation to estimate non-tree biomass estimates
Percentage of canopy cover	% of land area	Eco-region	10 yrs and/ or 1 yr	JDI & SNB	—
Percentage of biomass volume by general forest type	Yield curves	Eco-region	5 yrs	FMF	•Related to 1.1 a / b
Soil carbon pools	—	—	—	—	—
Soil carbon pools and decay rates	—	—	FMF/ GFERG	—	—
Area converted to/ from forest land use	Area (ha)	Eco-region	10 yrs and/ or 1 yr	FMF	—
Semi-permanent or temporary loss or gain of forest ecosystem, e.g., grasslands and agriculture	Area (ha)	Eco-region	10 yrs and/ or 1 yr	FMF & DNRE	—
Existence of forest inventories	—	DFA	?	DNRE	•No progress to date
Existence of laws and regulations on forest land management	—	DFA	?	DNRE	•No progress to date
Surface area of water within the forest area	Area (ha)	Watersheds	10 yrs	DNRE	•Complete summary of all major watersheds in the FMF.

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Annual removal of timber relative to volumes deemed sustainable	m^3/year	DFA	5 yrs	FMF, SNB & JDI	—
Availability of habitat for selected wildlife species of economic importance	Area of available habitat & Pop. est. from past	WMZ	5 yrs	DNRE	—
Changes in land use and/or ownership patterns that affect the area available for timber production	—	Municipal	5 yrs	FMF	•A complete landuse classification summary for the FMF. Related to socio-economic factor that govern landuse change
Trends in forest products and processes within the forest	m^3/year by product type	DFA	5 yrs	Crown, JDI & SNB	—
Trends in income and employment from timber and non-timber sources	Stats Canada census data	DFA	5 yrs	FMF & Province	•What timber & non-timber resources contribute to the local economy
Area and percentage of forest managed for other values by degree of protection	Area (ha)	Eco-region	5 yrs	FMF	•I.D non-timber values & how they can be incorporated into management plans
Availability, potential, and use of non-timber benefits	—	—	—	—	—

Note: The indicators in Criterion 5 will be replaced by an expanded, more comprehensive set, still in draft form.

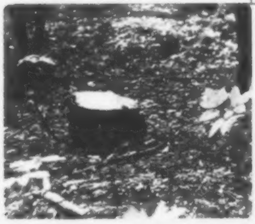
Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent to which forest management planning takes into account the protection of Aboriginal social, cultural, or spiritual sites	—	—	—	—	—
Assessing the level of understanding that all parties involved in the forest management planning operations have of Aboriginal issues	Qualitative	DFA	5 yrs	Workshops	—
Number of communities with stewardship or co-management responsibilities	Qualitative	DFA	5 yrs	FMF	—
Degree of public participation in decision-making process	Qualitative	DFA	5 yrs	FMF / DNRE	—
Degree of implementation of local planning process and BMP's by landowners and managers	Qualitative	DFA	5 yrs	FMF	—
Percentage of area covered by multi-attribute resource inventories	Qualitative	DFA	5 yrs	FMF	—
Effectiveness of public education	Qualitative	—	—	—	—

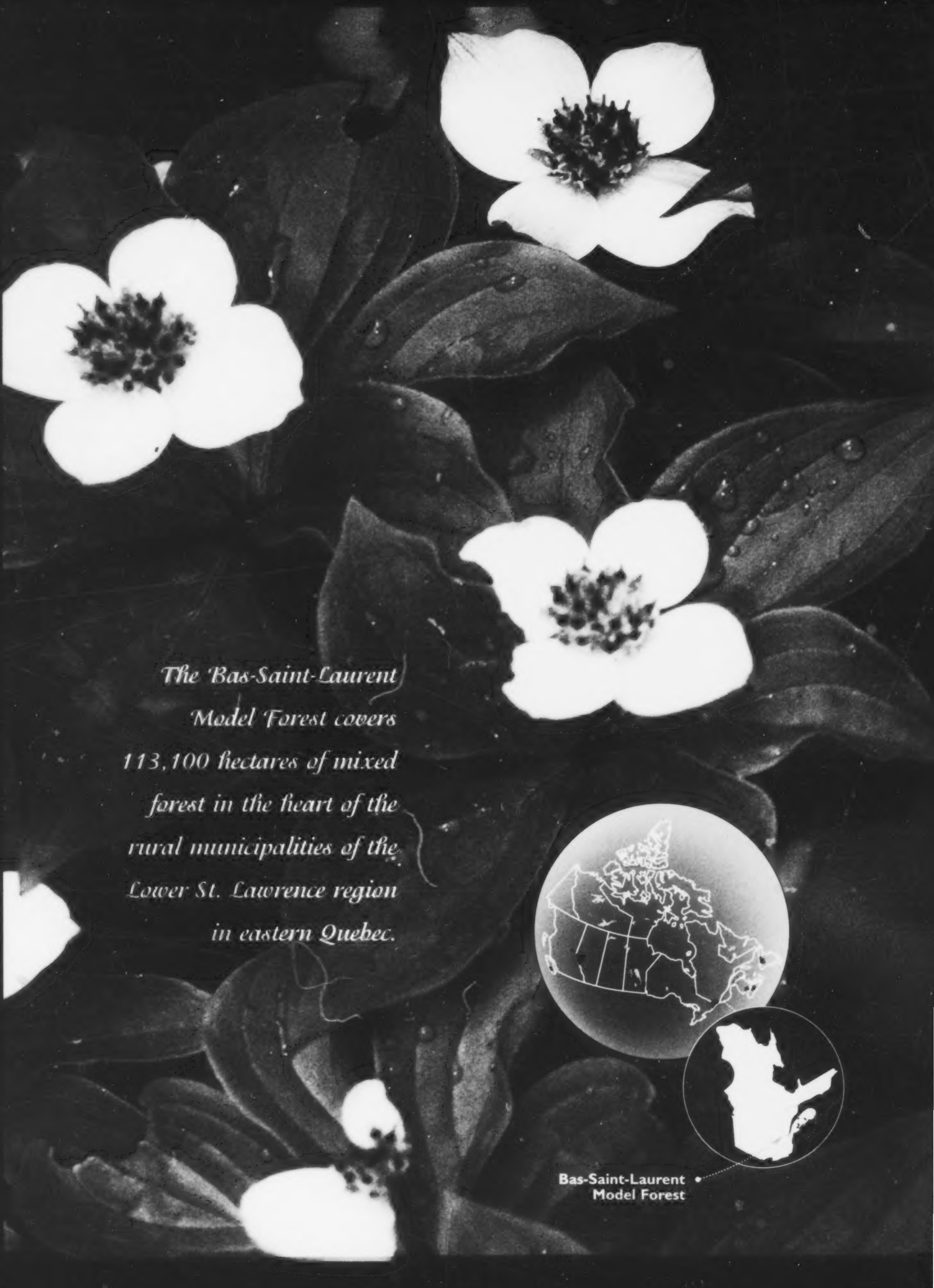
continued on the next page

Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Level of technology transfer activities in the Model Forest	Qualitative	Regional	Annual	GFERG / FMF	—
Percentage of forest area under management plans which has included local and meaningful participation that represents the concerns of the local area	Qualitative	DFA	5 yrs	GFERG, SNB & FMF	—
Existence of an inventory outlining the most effective conservation practices relating to the public use of forest products	Qualitative	Regional / National	5 yrs	FMF/CFS	—
Degree of implementation of most effective conservation practices relating to the use of forest products	Qualitative	Regional / National	5 yrs	FMF/CFS	—



ABBREVIATIONS
BMP: Best Management Practice
GFERG: Greater Fundy Ecosystem Research Group
CWS: Canadian Wildlife Service
JDI: J.D. Irving, Limited
DFA: Defined Forest Area
MAI: Mean Annual Increment
DNRE: New Brunswick Department of Natural Resources and Energy
SBWDSS: Spruce Budworm Decision Support System
DOE: Department of the Environment
SNB: Southern New Brunswick Wood Cooperative
ELC: Ecological Land Classification
UNB: University of New Brunswick
FMF: Fundy Model Forest
WMZ: Wildlife Management Zone
FNP: Fundy National Park


Bas-Saint-Laurent
Model Forest

The Bas-Saint-Laurent Model Forest covers 113,100 hectares of mixed forest in the heart of the rural municipalities of the Lower St. Lawrence region in eastern Quebec.

BAS-SAINT-LAURENT MODEL FOREST

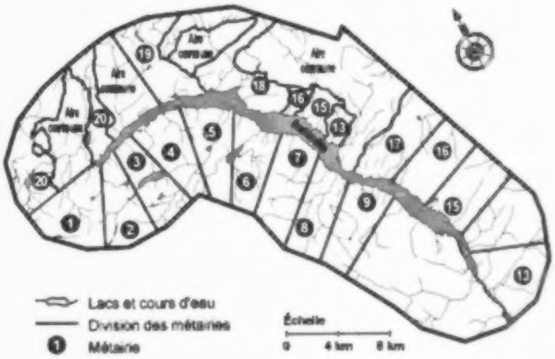
BACKGROUND

The Bas-Saint-Laurent Model Forest covers 113,100 hectares of mixed forest in the heart of the rural municipalities of the Lower St. Lawrence region in eastern Quebec. It is made up of three distinct sections, all private woodlots: the Nicolas Riou and Lac-Métis seigneuries owned by Abitibi-Consolidated and the area served by Le Groupement forestier de l'Est du Lac Témiscouata. These holdings rank among the most productive of the Great Lakes forest region and include several major bodies of water. Stands of balsam fir and yellow birch cover most of the area with maple also an important species in one district.

The four principal sponsors of the Bas-Saint-Laurent Model Forest are Abitibi-Consolidated, Laval University, Le Groupement forestier de l'Est du Lac Témiscouata, and the Syndicat des producteurs de bois du Bas-Saint-Laurent. In addition, more than 40 partners, representing a very diverse group of stakeholders, work on various projects in the Model Forest.

The Bas-Saint-Laurent Model Forest is experimenting with two very different forest management strategies: forest tenant farms and group ventures. Forest tenant farming, which has been ongoing since 1994 in the seigneuries of Nicolas Riou and Lac-Métis (divided into 10 and 13 farms respectively), involves the allocation of an area averaging 1,000 hectares to the farmer who ensures viable multi-resource management of the land. Forest tenant farmers join forces to manage common activities such as hunting and fishing.

Le Groupement forestier de l'Est du Lac Témiscouata oversees the group venture, a formula being tested in its area, which includes six municipalities and 700 woodlot owners. The aim of Le Groupement forestier is to diversify the ways in which small woodlots can be used to produce income. Group ventures have developed expertise in watercourse management for wildlife habitat and have implemented numerous projects such as the development and application of wildlife management models.



INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

During the period of 1992–1997 the Bas-Saint-Laurent Model Forest carried out a series of meetings and discussions between members of committees overseeing the forest tenant farming and group venture approaches described above. The viewpoints identified during these discussions were incorporated into management plans which went through a public consultation process before they were adopted by the two committees. These resource plans serve as a guide to assist woodlot owners to manage and harvest the resources in their woodlots while respecting the forest ecosystem. The plans include a code of ethics, a description of four main land-use areas or zones (resource conservation, resource protection, site-specific management areas, and forest management area with light recreation) and a series of management strategies for each resource in the territory (timber, wildlife, water, and recreation). This management plan model has been fully implemented throughout the Bas-Saint-Laurent region and strongly influences the way management plans are structured in private forests throughout the province of Québec.

Initial purpose

The initial objective of the Bas-Saint-Laurent's Model Forest LLI initiative, as formulated in its 1997 five-year work plan, was to develop a set of feasible indicators that could be measured and analysed on a seasonal basis permitting the Model Forest to identify trends and, where necessary, review existing policies and improve field operations. The indicators program could, in this way, measure the effectiveness of the management plans that had already been developed and approved. There was also an interest in forest certification, either to register the entire Model Forest as a certified territory or to assist in the preparation of certified plans.

Getting started on the work program

The Model Forest identified a staff specialist who has devoted about half of his time since 1997 on keeping the local level indicators initiatives moving forward. It was agreed that it would be useful to identify local values that could be used to guide the development of local level indicators. These values were derived from the management plans that had been developed previously. The values were not explicitly stated in the management plans but were implicit in the various objectives identified so a careful review was done in order to derive clear value statements from these plans. The results were brought to a public meeting in February 1998 where they were discussed and approved.

EXPERIENCE GAINED — INDICATORS AND FOREST CERTIFICATION

The Bas-Saint-Laurent Model Forest began its work on criteria and indicators by trying to combine expectations of the Model Forest Network with the requirements of the Canadian Standards Association's Sustainable Forest Management standard. It turned out that the CSA standard was not readily compatible with the context of private woodlot management and efforts recently shifted towards addressing the requirements of the Forest Stewardship Council which is more oriented towards market expectations. Much effort would have been saved had this decision been taken at the outset.

SELECTING INDICATORS

Initial indicators

The Bas-Saint-Laurent Model Forest began by adopting the framework of criteria used by the Canadian Council of Forest Ministers. An initial set of indicators was compiled from a variety of sources including the CCFM indicators as well as publications from the provincial government, the Féderation des producteurs de bois du Québec, and other sources. These indicators were then evaluated by members of the Board of Directors and reconciled with the values that were identified in the Forest Management Plan. This resulted in a set of 63 indicators.

Refining the indicators

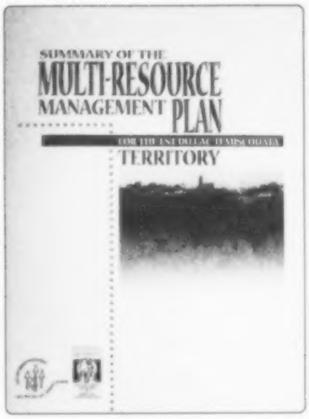
This initial set of indicators was further reduced using the screening criteria identified in the sidebar. The aim was to limit wherever possible the need for on-site monitoring which was likely to be impractical in an area with so much privately owned land. It was also important to develop indicators that show overall trends over time (both biophysical and socio-economic) rather than using relatively simplistic "yes/no" indicators.

This refinement process resulted in a set of 35 indicators, each one listed along with:

a) the local value it is intended to address;
b) the management zone(s) that it applies to (see Background Section);
c) the unit of measure
d) the measurement interval;
e) sources of data; and
f) further research and development needs.

INDICATOR SCREENING CRITERIA

1. Currently measurable
2. Measurable at a reasonable cost
3. Can demonstrate forest trends


SUMMARY OF THE
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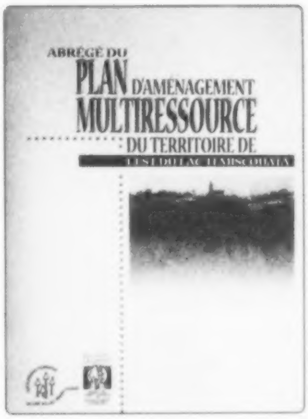
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PLAN D'AMÉNAGEMENT
MULTIRESSOURCE
DU TERRITOIRE DE

Further testing

The Bas-Saint-Laurent Model Forest recognizes that even a reduced set of 35 indicators is likely not practical and hopes to reduce this list considerably to ten or fewer indicators if possible. In this respect it is working to identify indicators from the core set that might be considered "key" indicators.

GATHERING DATA

Initial assessment

Because of the difficulties involved in taking extensive field measurements on private lands with many diverse owners, much of the work of the Bas-Saint-Laurent Model Forest has focussed on developing monitoring methods that take full advantage of existing information and information that can be readily integrated into GIS databases.

Roles and responsibilities

Overall coordination of the monitoring work is overseen by a staff specialist.

Current status

Some key research and development needs have been identified for the Bas-Saint-Laurent Model Forest. Special efforts are needed to test the proposed watershed vegetation indicators and to gather information such as forest type and age class distribution, extent and area of clearcuts, and annual removals relative to the forest's productive capacity.

Some specific research projects are being undertaken that are expected to produce results that will assist in any monitoring program in the region include:

- the testing of a bird diversity predicting model that uses forest survey data.
- field validation on the use of watershed vegetation indicators.
- the refining of soil conservation indicators after analysing field data that will help to identify soils with a higher risk of erosion.
- Setting thresholds for ecosystem diversity that will better allow harvesting methods to be modelled on natural disturbance regimes in mixed wood stands.

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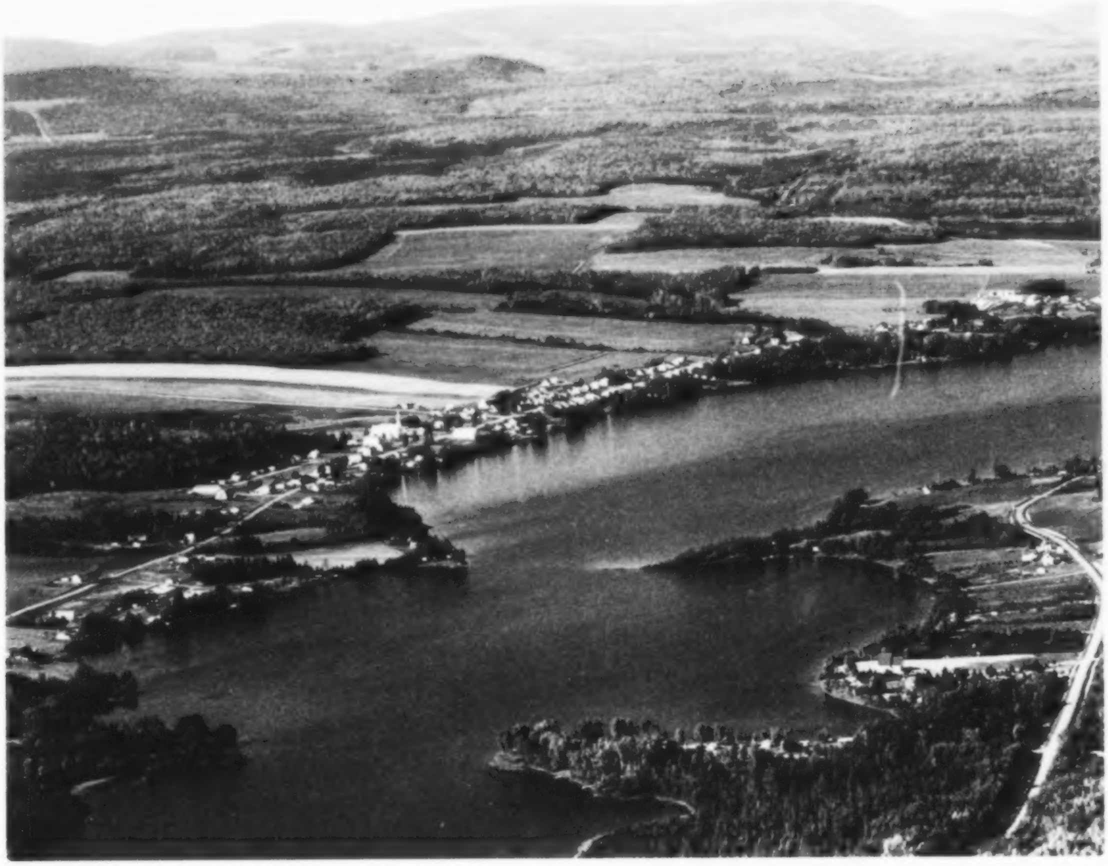
Other research and development needs will address the need for good information on socio-economic indicators.

Ongoing monitoring

A monitoring plan is in the process of being developed by Model Forest staff. It is anticipated that Model Forest staff will be responsible for monitoring and storing this data although, as mentioned above, the Model Forest will be relying on existing data sets or on information that can be gathered without extensive field work.



USING AND REPORTING ON INDICATORS

Use of indicators in private forests: In 1997 the Bas- Saint-Laurent Model Forest served as technical advisor to the Fédération des producteurs de bois de Québec for the development of an indicator proposal for Québec's private forests. The Model Forest remains in contact with the provincial team in charge of developing indicators.

Management planning: Management plans are currently going through a revision process in order to make a clearer link between the protection guidelines built into previous plans and the local level indicators framework developed since those plans were completed. This will call for the development of quantifiable objectives that meet the protection requirements, are based on relevant scientific information, and can be readily measured.

Forest certification: Attention is now focussing on working with the landowners to meet management and monitoring requirements under the Forest Stewardship Council's certification system.

NEXT STEPS

Key activities over the coming year will include:

- completing a report describing the first indicator measurements;
- develop methods and protocols for monitoring including the establishment of quantifiable objectives;
- implement GIS tools to increase the ease with which forest maps can be updated;
- put the updated content of the Bas-Saint-Laurent Model Forest's work on indicators on its web site;
- contribute towards the development of a regional FSC standard; and
- work with landowners towards certification to the FSC standard.

Publications and reports

Belleau, Pierre. February 2000. *Development of the Bas-Saint-Laurent Model Forest Monitoring System: Selection of Local Criteria and Indicators for Sustainable Forest Management.* Bas-Saint-Laurent Model Forest, 25 pgs.

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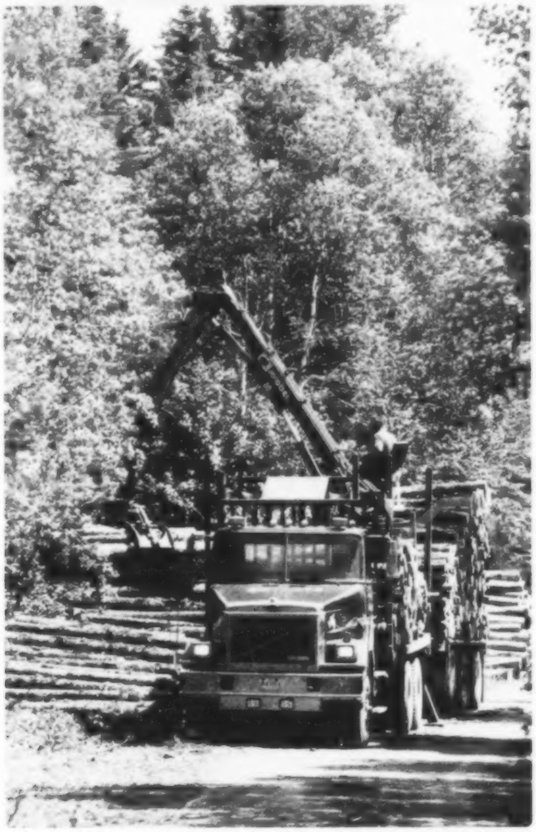


TABLE 3.5: LOCAL LEVEL INDICATORS OF THE BAS-SAINT-LAURENT MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Distribution of cover types and age classes per cover type	%	All	Annually	GIS	•Key indicator
Average area of total clear cut	hectares	All	Annually	GIS	—
Forest management activities, not set out in the management plan, in rare or fragile eco-systems (alder stands, denuded, semi-denuded, islands and islets)	Frequency & hectares	—	Annually	GIS	—
Diversity of bird populations	Abundance	All	Annually	GIS & CWS	—
Forest management activities, not set out in the management plan, in the habitat of threatened, vulnerable or exotic species	Frequency & hectares	—	Annually	GIS	—
Naturally regenerated areas relative to reforested areas	Hectares	All	Annually	GIS	—

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area occupied by exotic species	Hectares	All	Annually	GIS	—
Distribution of crown transparency by class	%	All	Annually	GIS	—
Distribution of cover types and age classes per cover type	%	All	Annually	GIS	•Key Indicator
Percentage of naturally regenerated areas relative to reforested areas	%	All	Annually	GIS	—
Average area and distribution of single species softwood plantations	Hectares	All	Annually	GIS	—
Forest biomass	ton/ha	All	Annually	GIS & LFC	—

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Forest management activities, not set out in the management plan, in sensitive areas	Frequency & Hectare	—	Annually	GIS	—
Distribution of crown transparency classes in watersheds	%	All	Annually	GIS	—
Surface area of wetlands, including bodies of water, within forested areas	Hectare	All	Annually	GIS	—
Unscheduled activity in managing the immediate environment of perennial and intermittent streams	Frequency & Hectare	—	Annually	GIS	—

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Forest biomass	ton/ha	All	Annually	GIS & LFC	—
Surface area of wetlands, including bodies of water, within forested areas	Hectare	All	Annually	GIS	—

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Annual sampling relative to forest production capacity per species category	m^3	All	Annually	SPB & ADM	•Key Indicator
Merchantable volume per species category	m^3	All	Annually	GIS	—
Distribution of age classes	m^3	All	Annually	GIS	—
Percentage of stand tending relative to all silvicultural practices	%	All	Annually	GIS	—
Distribution of cover types and age classes per cover type	%	All	Annually	GIS	•Key Indicator
Forest management activities, not set out in the management plan, in the immediate environment of perennial and intermittent streams	Frequency / Hectare	Annually	GIS	GIS	—

continued on the next page

Criterion 5
Multiple Benefits to Society — continued

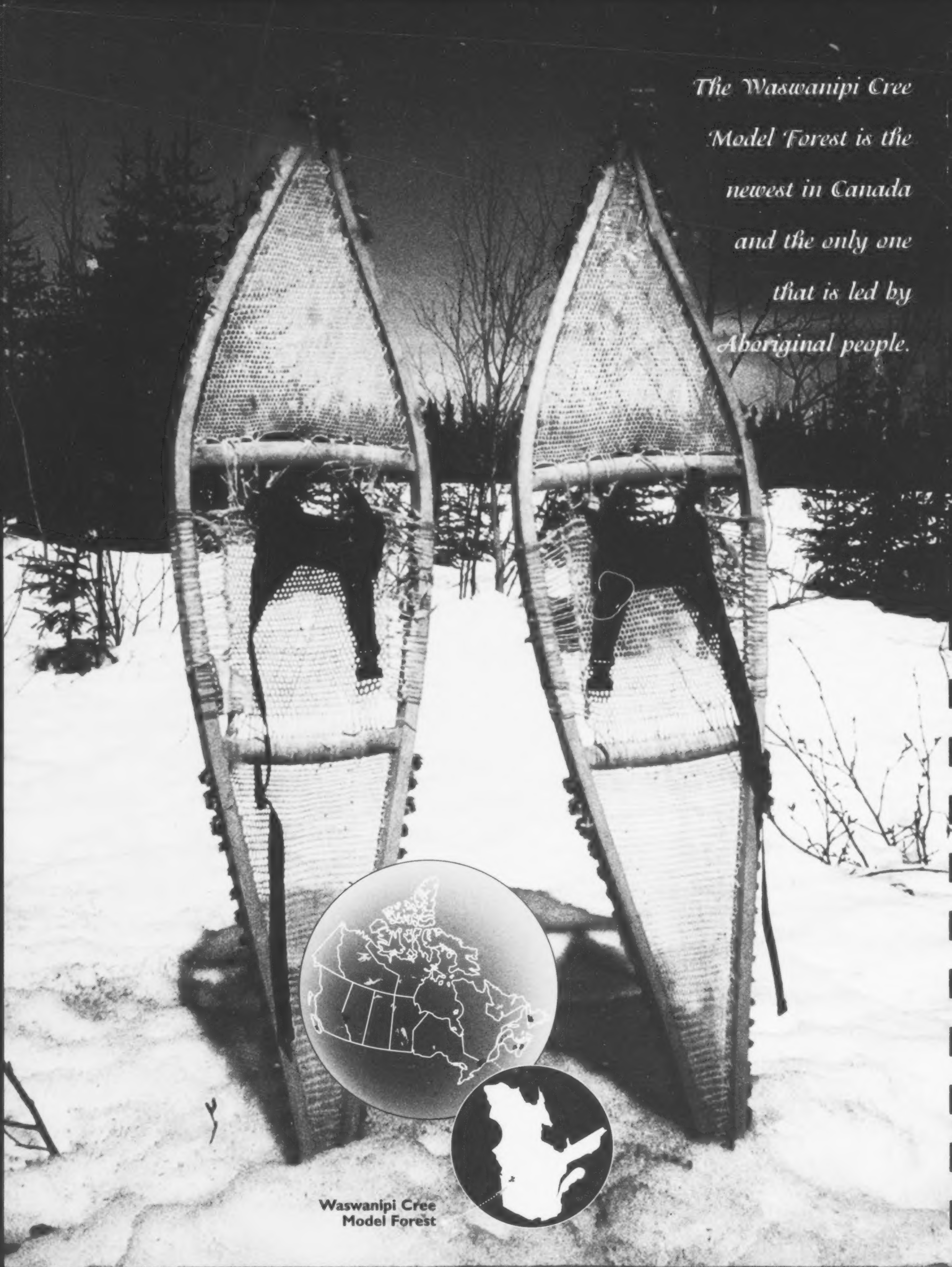
Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Forest management activities, not set out in the management plan, in winter moose and deer yards	Frequency / Hectare	—	Annually	GIS	—
Forest management activities, not set out in the management plan, in the immediate vicinity of sectors of interest	Frequency / Hectare	—	Annually	GIS	—
Population age structure **(G)**	%	n.a	5 yrs	Stats Canada	•Influenced by factors external to the model forest management system
Average income of tree farmers **(G)**	Dollars	n.a	5 yrs	Stats Canada	•Influenced by factors external to the model forest management system
Permanent and seasonal jobs (employment insurance) in the forestry sector relative to total jobs **(G)**	%	n.a	5 yrs	Stats Canada	•Influenced by factors external to the model forest management system
Average age of new employees entering the forestry sector **(G)**	Year	n.a	5 yrs	Stats Canada	•Influenced by factors external to the model forest management system
Degree of achievement of maple growing potential **(G)**	%	—	Annually	GIS	—
Average earnings of tree farms **(F)**	Dollars	n.a	Annually	ADM	—
Tree farm hiring **(F)**	Weeks — Hours	n.a	Annually	ADM	—
Value of sub-contracting	Dollars	n.a	Annually	ADM	—
Volume marketed per product category relative to forest capacity	m^3	n.a	Annually	SPB & ADM	—

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Annual consultations with the public and tenant farmers	Frequency	n.a	Annually	ADM	—
Financial participation in management and sustainable development	%	n.a	Annually	ADM	—
Investments in forest-related R&D	Dollars	n.a	Annually	MRN & ADM	—
Contribution to work-force training and public education in sustainable development	Dollars / Weeks	n.a	Annually	MRN, ADM & SPB Agency	—
Degree of public awareness of sustainable development	%	n.a	5 yrs	ADM	—

ABBREVIATIONS

ADM:	Internal management — Model Forest and Groupement forestier
MAM:	Quebec Department of Municipal Affairs
CWS:	Canadian Wildlife Service
AGENCY:	Regional private forest management agency
MEF:	Quebec Dept. of Environment and Wildlife
Stats Can:	Statistics Canada
LFC:	Laurentian Forestry Centre, Canadian Forest Service
RCM:	Regional County Municipality
SPB:	Syndicat des producteurs de bois du Bas-Saint-Laurent
F:	Tenant tree farm formula
G:	Co-management formula
GIS:	Numerical data from the Quebec Department of Natural Resources (MRN) and internal updates



The Waswanipi Cree Model Forest is the newest in Canada and the only one that is led by Aboriginal people.

Waswanipi Cree
Model Forest

WASWANIPI CREE MODEL FOREST

BACKGROUND

The Waswanipi Cree Model Forest is the newest in Canada and the only one that is led by Aboriginal people. It includes 209,685 hectares of boreal forest under the direct control of the community and is located about eight hours north of Montréal in the James Bay area.

Some 13 partners have come together to work in the Waswanipi Cree Model Forest. They include representatives of First Nations government, industry, academia and non-governmental organizations.

The goal of this Model Forest is to maintain and enhance the quality of the area, which is known as Eeyou Istchee (the people's land), to benefit Aboriginal and other users and to assure the economic, social and cultural development of the Waswanipi First Nation.

All activities of the Waswanipi Cree Model Forest reflect and address Cree interests and concerns with respect to the sharing of resources.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

There has been extensive activity related to indicator selection in the Waswanipi region, prior to and/or independent from the establishment of the Waswanipi Cree Model Forest. A report prepared in 1997 on behalf of the James Bay Advisory Committee on the Environment focuses attention on developing appropriate social, cultural and economic indicators (Carole Levesque and Christiane Montpetit, "Toward the Integrated and Sustainable Management of Forestry Activities in Eeyou Astchee"). Indicators from this report were later incorporated into a set of indicators adopted by the James Bay Advisory Committee on the Environment. This set of indicators is intended to apply to the entire territory covered by the 1975 James Bay Agreement, an area much larger than the Waswanipi Cree Model Forest.

Initial purpose

As part of its initial five-year work plan in 1997, the Waswanipi Cree Model Forest committed to undertake the "formidable" task of developing and measuring local level indicators of forest management. A particular challenge for this Model Forest was the need to "fully utilize Cree traditional knowledge to develop a suite of indicators for sustainable forest management *as defined by the local Cree community*" (from the proposal document, emphasis added). Moreover, it was recognized that it would be necessary to ensure that "the two suites of criteria and indicators developed (western science and traditional knowledge) are not contradictory or in conflict."

Getting started on the work program

Much of the initial two years of the Waswanipi Cree Model Forest has been devoted to building the partnership and establishing the relationships necessary to support the Model Forest. This is almost always a lengthy process and has proven to be especially difficult in Waswanipi due to ongoing treaty negotiations, a high-profile court case as well as upheavals and crises within the small community that command people's attention. Moreover, partnership discussions in the Waswanipi Cree Model Forest use three different languages which presents not just a translation problem but, perhaps more importantly, significant cultural barriers.

The Waswanipi Cree Model Forest is undertaking or involved with a number of projects that use local level indicators, either explicitly or implicitly (see section "E" below for a few examples). In 1999 the Model Forest recognized the need to bring some increased attention to the topic and to obtain Partnership commitment to a work plan. In order to help them do this they invited as a resource person someone who had experience with indicator development at a number of Model Forests. He visited the area, spoke with as many people and partners as possible, and reviewed the extensive background literature relating to indicator development and use in Waswanipi and the James Bay territory. Rather than recommending a stand-alone work program on local level indicators, he outlined four potential current and ongoing projects that could benefit from having local level indicators more explicitly incorporated into their activities.

They include:

a) use of indicators to address conflicts between trappers and forestry operations;

b) use of indicators to foster best management practises within Mishtuk Corporation, the Cree-owned forestry company;

c) assisting in the development of local level indicators to monitor the implementation of the James Bay Agreement and the impacts of various activities throughout the James Bay territory; and

d) assisting in raising community awareness and understanding of forest management issues and sustainable forest management.

The Model Forest partnership has yet to decide on which of these or other possible local level indicators activities are to be a priority for the Model Forest.

LESSONS LEARNED — UNDERSTANDING KEY CONCEPTS

- The concept of indicators is not well understood by the majority of citizens. It is an indirect means to assess and monitor forest health over a period of time.
- For the Cree partnership it seems premature to tackle the development of local level indicators prior to developing better forest management strategies. It is like trying to pluck a goose before you have managed to kill one.
- Not everyone is comfortable with the concepts of criteria and indicators and local level indicators. Under these circumstances it is not easy to decide on the best course of action; to spend the time at the beginning to get everyone on side or to plunge into it and make it a learning process for everyone.

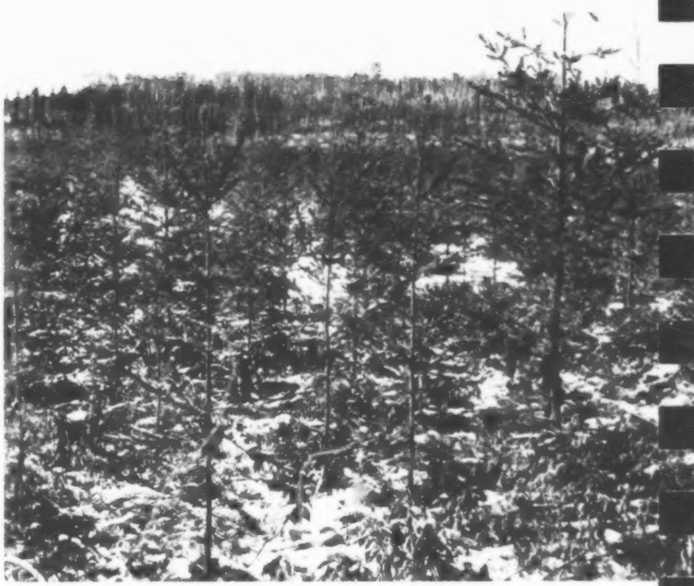
SELECTING INDICATORS

Initial indicators

The Waswanipi Cree Model Forest partnership has yet to endorse a particular set of indicators. However, it is expected that those being applied across the James Bay territory are likely to provide at least a reference point. This set departs significantly from indicator sets in use at other Model Forests across Canada in that it is structured around the rights described in the James Bay and Northern Québec Agreement and uses the following criteria:

1. The protection of the physical and biological milieu (including biodiversity and the productivity of ecosystems);
2. The protection of Aboriginal people, their societies and community, and their economies;
3. The special status and involvement of the Cree in forest management and the recognition of their needs, knowledge and values; and
4. The protection of Aboriginal hunting, fishing and trapping rights and the protection of other rights and guarantees in favour of the Cree.

These criteria are intended to apply to the entire James Bay Cree territory, an area that includes but is considerably larger than, the Waswanipi Cree Model Forest. The Model Forest will assist in developing and implementing local level indicators that will enable assessment of these criteria at the scale of a forest management district or trap-line. In this way the Waswanipi Cree Model Forest will be working with indicators that have been selected by the James Bay Advisory Committee on the Environment supplementing them where necessary to provide adequate coverage at the local scale. The information in the rest of this section, therefore, refers both to work led by the James Bay Advisory Committee on the Environment with the participation of the Waswanipi Cree Model Forest as well as specific projects led by the Model Forest.



Refining the indicators

In September 1999 a workshop was hosted by the James Bay Advisory Committee on the Environment. The aim of the workshop was to refine a preliminary list of indicators and to elicit commitments from management agencies (the

province as well as forestry companies) to monitor and report on specific indicators. Although progress was made during this workshop, some of the issues raised proved to be too complex to be resolved at a single workshop.

Further testing

The Waswanipi Cree Model Forest is seeking to get more detailed First Nations perspectives on various indicators that have impact at the local level. One project that has particular relevance to this initiative involves identifying appropriate indicators of Cree participation in forest management. Two indicators identified in the work of the James Bay Advisory Committee on the Environment have been explored in detail and expanded into a subset of nine indicators to be applied at the local or community scale. Other projects are more generally aimed at working to resolve conflicts between trappers and forestry companies and local level indicators are seen as a potential tool to measure and assess the effectiveness of commitments made as part of these conflict resolution processes.

GATHERING DATA

Initial assessment

An initial assessment was carried out as part of the preparatory work leading up to the September 1999 workshop, describing in a general sense the potential sources for various data. This work is being revisited as a result of the workshop since a great many of the indicators will require dedicated monitoring programs some of which may prove quite costly.

Roles and responsibilities

Agencies that attended the September 1999 workshop are determining their ability to commit to various monitoring programs that have been proposed.

Current status

The various parties involved in carrying out the indicators work proposed by the James Bay Advisory Committee on the Environment have yet to clarify and affirm their specific commitments. Agencies involvement in this process is currently under discussion.

Ongoing monitoring

It is expected that ongoing monitoring responsibilities will be allocated among a variety of agencies and will report to the James Bay Advisory Committee on the Environment.

LESSONS LEARNED — GATHERING DATA

The problem of a lack of baseline information is compounded by the geographic remoteness of the Cree territory. The Cree people have an abundance of information and observations, which to date have not been formalized (or accepted by western resource managers) which could accelerate the process of implementing local level indicators. There is the added benefit that there are many people who could collect field observations if the Model Forest developed an appropriate methodology and systematized this information for use of measuring indicators.

USING AND REPORTING ON INDICATORS

The Model Forest partnership has yet to decide exactly how best to use local level indicators within its overall work program. However, a number of significant indicators-related projects are being conducted with local level indicators being integrated in these projects on an exploratory basis.

Indicators in management planning. A process is being developed to integrate 14 core indicators in the forestry companies' 25-year management plans within the planning process currently underway. A Call for Proposals has been issued to review the existing management plans.

Indicators and conflict resolution. There is a history of conflicts between trappers and forestry companies. There are several projects and ongoing negotiations aimed at addressing and resolving those conflicts; in particular, a project called N'doho Istchee (formerly known as the Trapline Pilot Project) which seeks to increase constructive dialogue between trappers and forestry companies and promote the implementation of solutions to persistent conflicts. Local level indicators have a role to play both in tracking the implementation of measures agreed to as well as testing their effectiveness in actually addressing the concerns that led to the conflict in the first place.

Other relevant programs include research to assess a variety of forest management practises (such as mosaic management, partial cutting, etc), using indicators to test the effectiveness of new technologies in carrying out ecological mapping, and developing indicators of Cree participation in forest management planning.

LESSONS LEARNED FROM DEVELOPING LLI IN EEYOU ISTCHEE

Local level indicators are particularly well suited to be defined and monitored by First Nations. Cree observations related to their environment are carefully tracked, and the fact that most families practices subsistence activities in the same geographic area for generations, enables a large corpus of field data to be gathered.

However, what the Cree observe and how they apply these observations to determine ecosystem health remains an area which has been poorly explored by forest managers. Cree knowledge has either been collected to validate western scientific observations or to create ethnographic studies (anthropological databases). To date there has been little effort to use Aboriginal knowledge to improve sustainable forest management or the indicators of this progress.

The primary reason for this is that most efforts to develop indicators have occurred in workshop settings and within a formal policy development framework (forest managers, government officials and academics). The concept and constructs of forest management have not been made accessible to First Nations, let alone the notions of indices and measures of sustainability. In addition, there remains a lack of recognition of aboriginal environmental observations and knowledge, and whether (and more importantly how) information emanating from a native person can be used in a formal policy setting. Western science has yet to apply Aboriginal environmental knowledge as questions still arise regarding its accuracy, validity and reproducibility.

In the course of developing regional indicators for Eeyou Istchee, and using this suite to guide the Waswanipi Cree Model Forest to develop local level indicators and measures, we have tried to go back to the source, namely the land, and the trapline management system of the Cree hunting society. When we discuss with families how they determine and track the health of their land base, we are given good leads on elements to pursue.

NEXT STEPS

Priority areas for the Waswanipi Cree Model Forest'swork on local level indicators in the coming year includes:

- Establish a clear set of priorities;
- Raise the comfort level of partners in dealing with indicators, by fostering increased dialogue over a common core of information;
- Make progress on the N'doho Istchee project, including the implementation of activities that will help to resolve conflicts.;
- Create an indicators component to every project supported by the Waswanipi Cree Model Forest, maximizing the potential of indicators to be used as a tool for communications; and
- Explore an approach or approaches to resolving the disparity between scientific and Cree indicators, either by seeking to integrate approaches in a common framework or by carrying out parallel processes, with cross-fertilization.

Publications and reports

James Bay Advisory Committee on the Environment. January 1999. *A Proposal for the First Approximation of Criteria and Indicators of Sustainable Forest Management for Eeyou Istchee*. 61 pgs.

Pelletier, Martin, and Bouthillier, Luc. undated. *Assessing Participation in Forest Management*. Waswanipi Trap-line Pilot Project and Waswanipi Cree Model Forest, 10 pgs.

von Mirbach, Martin. November 1999. *Local level Indicators for the Waswanipi Cree Model Forest — Phase One Report: Initial Scoping Session*. Centre for Forest and Environmental Studies, 13 pgs.

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TABLE 3.6: LOCAL LEVEL INDICATORS OF THE WASWANIPI CREE MODEL FOREST

Criterion 1: The protection of the physical and biological milieu (including biodiversity and the productivity of ecosystems)

GOAL 1.1

To promote the principals of sustainable development in the use and management of the natural resources of Eeyou Istchee

Indicator	Unit of Measure
Forest practices code approved and implemented	•Presence/absence of forest practices codes •Number of infractions against forest practices codes •Variation in percentage of harvest areas having significant site degradation
Satisfaction rate for forest practices	•Satisfaction rate for forest practices
Visual landscape analysis tools	—
Integration of map values in the planning process	—
Landscape diversity	•Landscape diversity indices •Variation in ecotype
Forest diversity	•Variation and extent of forest type relative to total forest area •Percentage area by forest type and age class •Frequency distribution of age classes for each forest type and for entire forest
Forest fragmentation and patch size diversity	•Patch size diversity frequency distribution for each forest type and for entire forest •Level of fragmentation and connectivity of forest ecosystems
Landscape disturbance patterns	•Ratio of area of the natural forest to area in clear-cut and plantations •Trends in the sizes of harvested areas •Variation in the percentage of forest in roadless areas
Growth and productivity rates	—

Criterion 1

The protection of the physical and biological milieu (including biodiversity and the productivity of ecosystems) — continued

GOAL 1.2:

TO PROMOTE THE INTEGRATION OF CREE ENVIRONMENTAL KNOWLEDGE IN THE SUSTAINABLE DEVELOPMENT OF EEYOU ISTCHEE

Indicator	Unit of Measure
Number of updates made to database	—
Presence/absence of Cree environmental knowledge in Timber Management Plans	•Existence of administrative mechanisms and protocols/ guidelines for the access to and dissemination of Cree environmental knowledge
Presence of Cree occupancy maps	•Yes/no presence of Cree occupancy maps
Trends in the number of permits issued for hunting, fishing, and land leases	•Number of annual hunting, fishing and land lease permits issued and in the annual number of user days for recreation
Trend/number of user days for recreation purposes	•Number of annual hunting, fishing and land lease permits issued and in the annual number of user days for recreation

Criterion 2.1: The protection of Aboriginal people, their societies and community, and their economics

GOAL 2.1:

TO PROMOTE VERSATILE USE AND THE SUSTAINABLE DEVELOPMENT OF THE RESOURCES OF EEYOU ISTCHEE WHILE ENSURING THE CONTINUATION OF THE CREE WAYS OF LIFE

Indicator	Unit of Measure
Presence/absence of regularly updated maps or model of habitat elements essential to Cree hunters	•Yes/no presence of regularly updated maps or models of habitat
Modified silvicultural operations for the protection/management of Cree hunting areas	•Level of protection of habitat elements essential to the Cree
Presence/absence of Cree Trappers Association programs that promote hunting, fishing and trapping	•Yes/no presence of CTA programs that promote hunting, fishing and trapping

continued on the next page

Criterion 2.1

The protection of Aboriginal people, their societies and community, and their economics — continued

Indicator	Unit of Measure
Trends in level of funding available to support CTA programs	•Number and diversity of CTA programs and other trappers support programs offered
Trends in CTA program participation over time	•CTA program annual budget •Number and description of CTA activities •Level of satisfaction of program participants with hunting, fishing and trapping results
Trends in key species population levels	—
Trends in harvest levels of key species	•Yes/no harvest levels and opinion on the harvest trends
Total number of person-days spent in the forest vs. hunting, fishing, trapping success (hunting effort)	•Ratio of the number of days spent in the forest vs. hunting, fishing, trapping success
Presence/absence of HFTCC wildlife management plans	•Yes/no presence of HFTCC wildlife management plans
Level of funding available to prepare the wildlife management plans and conduct key species population surveys	•5 yr budgets for preparation of wildlife management plans
Participation of HFTCC in timber management planning process	•Number of exchanges between HFTCC and timber managers, list of attendees
Implementation of HFTCC in timber wildlife plans	—
Status of big game populations and trends in population survey data	—
Number of non-native wildlife kills	—
Presence/absence of natural history maps and trap-line descriptions	—
Trend of trap-line mobility among the Cree over time	—
Presence/absence of contemporary land use and occupancy information	•Yes/no presence of contemporary land use and occupancy information

continued on the next page

Criterion 2.1
The protection of Aboriginal people, their societies and community, and their economics — continued

Indicator	Unit of Measure
Level of funding for land use and occupancy initiatives	—
Number and geographic distribution of persons (families)	—
Land alienation statistics	•Area lost due to land alienation (ha/alienation type)
Presence/absence of trap-line boundaries in timber management plans	—
Presence/absence of forest management plans that integrate HFTCC approved road network plans	•Yes/no presence of forest management plans that integrate HFTCC approved road network plans
Development of forestry road remediation plan	•Ratio of roadbed area vs. no-roadbed area •Number of kilometres of controlled and/or supervised access
Sustainable forest management audits will be carried out every five years per CAAF, cooperatively between proponents and designated representatives from the Cree community	•Yes/no results of audit

Criterion 3: The special status and involvement of the Cree in forest management and the recognition of their needs, knowledge and values

GOAL 3.1:

TO ENSURE FOR THE MEANINGFUL INCORPORATION OF CREE KNOWLEDGE AND OPINIONS IN THE ADMINISTRATION, DEVELOPMENT AND MANAGEMENT OF NATURAL RESOURCES IN EEYOU ISTCHEE

Indicator	Unit of Measure
Degree of Cree participation in the design and implementation of decision-making processes, and in the monitoring and evaluation of the forest management planning process	•Number of youth, women, wage earners and members of the mixed subsistence economy participating in the sustainable forest management process
Community satisfaction with participation in forest management planning process	•Number of management plans sanctioned by the Cree
Trends in funding available for the Cree to mitigate forest management plans and trends in compensation claims and settlements	•Number of revisions made to management plans to accommodate Cree needs and perspectives

Criterion 3

The special status and involvement of the Cree in forest management and the recognition of their needs, knowledge and values — continued

GOAL 3.2

TO ENSURE FOR THE FULL AND EFFECTIVE PARTICIPATION OF THE CREE IN THE ADMINISTRATION, DEVELOPMENT AND MANAGEMENT OF NATURAL RESOURCES OF EEYOU ISTCHEE

Indicator	Unit of Measure
Trends in Cree participation and employment in natural resource based activities	•Number of youth, women, wage earners and members of the mixed subsistence economy participating in the timber management planning process
Trends in funding levels for training of Cree people in natural resource-based activities	

GOAL 3.3:

TO INCLUDE CREE LAND USE IN NATURAL RESOURCE AND LAND USE DEVELOPMENT ACTIVITIES IN EEYOU ISCHEE

Indicator	Unit of Measure
Sites significant to the Cree conserved or protected	•Presence/absence of Cree values maps
Maps and reports of geographic distribution and rate of the timber harvest in appropriate spatial scales: trap-line, community and region	•Presence/absence of forest harvest disturbance mps by trap-line, community and region
Cree values maps prepared and updated at regular intervals	•Presence/absence of Cree values maps
Cree values maps included in all timber management plans	•Presence/absence of Cree value maps
Cree participation on timber management planning team	•Number of Cree members involved, and the roles they play in the management planning process
Appropriate levels of funding to support local environmental protection activities	•Level of financial support for local environmental activities
Resource management agreements between Cree and CAAF Agreement Holders	•Presence/absence of resource management agreements involving the Cree

Criterion 3

The special status and involvement of the Cree in forest management and the recognition of their needs, knowledge and values — continued

Goal 3.4

To increase the diversity of forest based economic and social benefits to Cree communities

Indicator	Unit of Measure
Number of Cree-owned and managed natural resources based businesses (at both community and regional levels)	•Ratio of Cree/non-aboriginal businesses in operation within the Eeyou Istchee
Number of Cree held CAAF agreements or CAF	—
Number of Cree owned and managed service and secondary industries (at both community and regional levels)	—
Level of financial assistance made available to Cree people (i.e. number of loans, grants, etc)	—

Criterion 4: The protection of Aboriginal hunting, fishing and trapping rights and the protection of other rights and guarantees in favour of the Cree

Goal 4.1:

To respect the spirit, intent, rights and guarantees mandated to the Aboriginal people by the JBNQA

Indicator	Unit of Measure
Mandate of JBACE. Given operational definition, sufficient resources to function adequately and respected by government authorities	•Presence/absence of JBACE mandate
Institutionalization of JBACE in forest management regime	•JBACE analysis/reports on forest management plans and modifications

Criterion 4
The protection of Aboriginal hunting, fishing and trapping rights
and the protection of other rights and guarantees in favour of the Cree — continued

GOAL 4.2:

TO ENSURE THE PROTECTION OF CREE HUNTING, FISHING AND TRAPPING RIGHTS

Indicator	Unit of Measure
Upgraded hunting, fishing and trapping harvest level guarantees	•Presence/absence of modified hunting, fishing and trapping harvest level guarantees

GOAL 4.3:

TO ENSURE THE CONTINUATION OF THE INCOME SECURITY PROGRAM

Indicator	Unit of Measure
Variation in age distribution of participants, and trends in youth participation	•Variation in the rate of participation
Level of economic benefits (market/mixed economy market goods)	

Criterion 4
The protection of Aboriginal hunting, fishing and trapping rights
and the protection of other rights and guarantees in favour of the Cree — continued

GOAL 4.4:

TO ENSURE THAT THE CREE HAVE CONTINUED ACCESS TO NATURAL RESOURCES OF SUFFICIENT QUALITY AND QUANTITY TO MEET THEIR CURRENT AND FUTURE NEEDS IN ACCORDANCE OF THE AGREEMENT

Indicator	Unit of Measure
Area of land available for Cree hunting, fishing and trapping	—
Quantity of species harvested and protected	•Annual timber harvest level relative to sustainable harvest level •Annual Cree harvest levels relative to sustainable total harvest level
Quantity of other resources gathered by the Cree	•Level of practice and trends and rate of participation in hunting, trapping and fishing and other social activities
Quality of species harvested and protected	•Level of practice and trends and rate of participation in hunting, trapping and fishing and other social activities
Quality of other resources gathered by the Cree	•Level of practice and trends and rate of participation in hunting, trapping and fishing and other social activities
Degree of land alienation	•Area of land alienation due to flooding and forestry (clear-cutting, roads, landings, etc.)
Existence of databases on Cree resource uses, harvest levels, and social, economic and cultural needs	—

continued on the next page

Criterion 3

The special status and involvement of the Cree in forest management and the recognition of their needs, knowledge and values — continued

Indicator	Unit of Measure
Existence of formalized and current Cree land use plans	—
Existence of new polices and programs	—
Existence of long term access road strategic plan	•Yes/no presence of long-term access road strategic plan

ABBREVIATIONS

CAAF: Contrat d'approvisionnement et d'aménagement forestier (Timber Supply and Forest Management Agreement)

CAF: Contrat d'aménagement forestier (Forest Management Agreement)

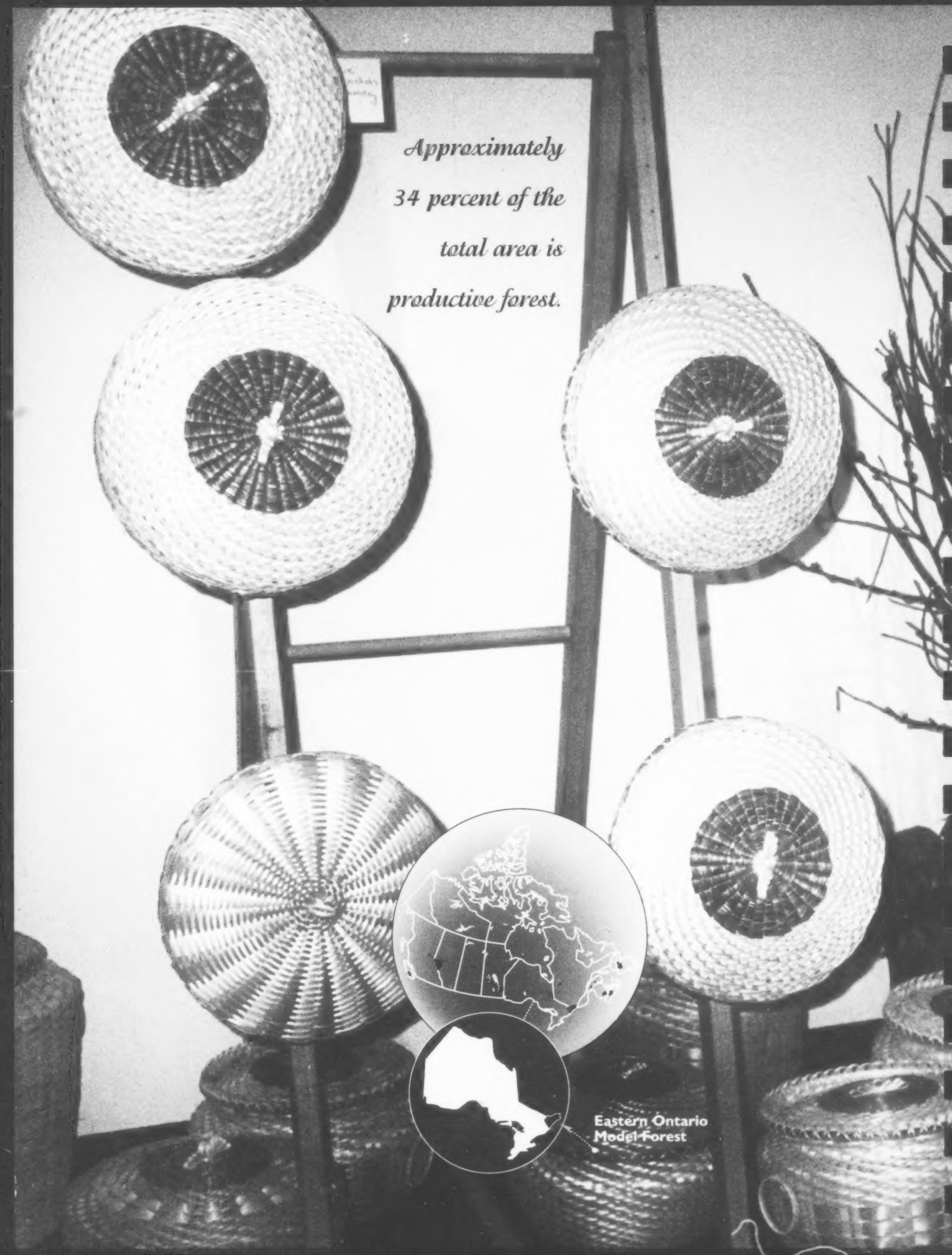
CTA: Cree Trappers Association

HFTCC: Hunting, Fishing and Trapping Coordinating Committee

JBACE: James Bay Advisory Committee on the Environment

JBNQA: James bay Northern Quebec Agreement

Approximately 34 percent of the total area is productive forest.


Eastern Ontario Model Forest

EASTERN ONTARIO MODEL FOREST

BACKGROUND

The Eastern Ontario Model Forest extends more than 1.5 million hectares — north from Gananoque on the St. Lawrence River, through the regional municipality of Ottawa-Carleton into Lanark County and east as far as the Québec border. It also encompasses the lands of the Mohawks of Akwesasne.

Approximately 34 percent of the total area is productive forest. Common species of this mixed forest include sugar and red maple, beech, yellow birch, basswood, white ash, white cedar, large tooth aspen, red and bur oaks, eastern hemlock, eastern white pine and white spruce.

There are about one million residents in the area of the Eastern Ontario Model Forest. About 88 percent of the area is privately owned, and the remainder is publicly-owned land.

A wide variety of partners work in the Eastern Ontario Model Forest representing government, academia, First Nations, industry, various environmental organizations and associations, international groups and agencies, as well as farms and agricultural enterprises.

Many projects of this Model Forest focus on the private land owner. Throughout the area, various forest demonstration sites continue to be established showcasing activities such as cultivation of native plants that have medicinal value, effective management of the sugar maple, more efficient thinning of red pine plantations, and sawlog production. A land owner workshop series is also being set up to complement the *Code of Forestry Practice* developed by the Eastern Ontario Model Forest.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

A number of relevant reports and studies were carried out by the Eastern Ontario Model Forest that helped to lay the groundwork for the detailed work plan developed in 1997 for the development and use of local level indicators. Most notable were two reports, one looking at ecological properties for the evaluation of eastern Ontario forest ecosystems (Keddy and Drummond 1995) and the other a systematic assessment of the Canadian Council of Forest Ministers' national indicators, determining their relevance to the Eastern Ontario Model Forest (Riley 1997).

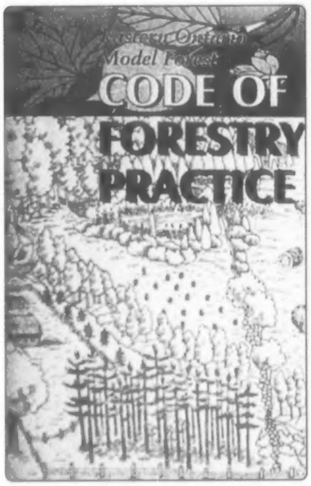
Initial purpose

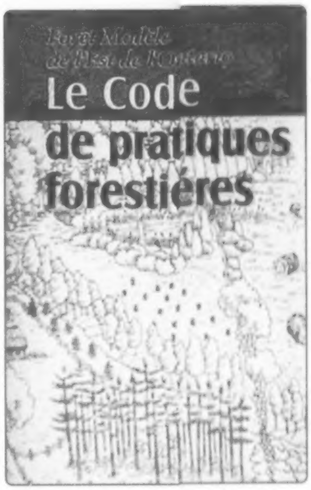
The work plan from 1997 describes a schedule of planned activities to establish indicators, to measure and monitor them, and to report on performance. A workshop in the summer of 1998 included a discussion of the specific reasons why the Model Forest wanted to work with local level indicators and to identify desired outcomes. Three outcomes were identified:

1. Provide a framework for measuring, analysing and reporting on the "State of the Forest" for the Eastern Ontario Model Forest area.
2. Provide an effective tool for communicating with the public, Eastern Ontario Model Forest partners and other interested parties about sustainable forest management.
3. Provide a framework to evaluate the effectiveness of the Model Forest projects and the Eastern Ontario Model Forest as a whole and to direct and focus Model Forest strategies and activities.

Getting started on the work program

A working group was struck in 1997, but shortly after formation it became evident that the people with greatest initial input into the LLI process were those with a science background. Since there was considerable overlap between the working group and the Forest Science Committee (a standing committee of the Model Forest), it was decided to transfer responsibility for LLI to the Forest Science Committee. The committee has 10 core members and includes representatives from the Board of Directors, a representative from the Mohawk Akwesasne Nation, and a Model Forest staff person as secretariat. As well, it draws on a large number of other experts from time to time to provide advice and guidance as needed.


Eastern Ontario Model Forest
CODE OF FORESTRY PRACTICE


Forêt Modèle de l'Est de l'Ontario
Le Code de pratiques forestières

Much of the Model Forest's activity related to LLI during 1997–1998 entailed developing a better understanding of the concepts involved. A consultant was given a mandate in June 1997 to help in the process of translating the highly technical language of criteria and indicators into plain language. This project involved a literature review, several meetings, a "Knowledgeable Evaluators Workshop", and a report that summarized and synthesized the findings (Lawn 1997).

LESSONS LEARNED — GETTING STARTED

- Involve as many stakeholders as possible.
- Organize workshops or symposia to discuss the rationale for work and also forest values.
- Keep stakeholders informed (e.g., through newsletter articles and other media).
- Ensure that management (i.e. Board of Directors) support is obtained.
- Develop a definite plan.

SELECTING INDICATORS

Initial indicators

In 1998 two consultants were hired to assist the Forest Science Committee to develop and refine a set of indicators for use by the Eastern Ontario Model Forest. Using information from eight sources, chiefly the CCFM set (relying on the analysis previously done by Lorne Riley) and a set that

had recently been developed for the Great Lakes Forest Alliance, they compiled an initial large set of about one hundred indicators relevant at the local level within eastern Ontario.

Refining the indicators

After some discussion, the Forest Science Committee decided that rather than start off right away by committing to a fully comprehensive set of indicators, it would begin with a "starter set" and build from there. The advantage of this approach is that it would start to show results right away and would help to move the Model Forest beyond the conceptual phase of grappling with LLI. The large set of indicators was then screened according to the criteria listed in the sidebar. In addition, efforts were made to ensure that there was adequate coverage under each criterion to give a reasonable overview of at least the most important aspects of that criterion and the values associated with it. The consultants prepared an initial set which was then reviewed, discussed, modified and approved by the Forest Science Committee.

Further testing and filling gaps

This "starter set" had from the outset been designed to be used in the first State of the Forest Report. This allowed the Model Forest to move directly from indicator selection to data gathering. It was recognized from the outset that there would be major data gaps which were identified through two means. The consultant who gathered the information and wrote the *State of the Forest Report* included an appendix that looked at data limitations for each indicator and proposed future directions. As well, the Model Forest commissioned an external review and gap analysis of the report (Duinker and Saunders, forthcoming), which will help the Model Forest direct its future activities towards filling in these gaps and improving the breadth, depth and rigour of its reporting on SFM in future reports.

INDICATOR SCREENING CRITERIA

1. Data is readily available in a format and scale that is useful.
2. Data is reasonably reliable.
3. The indicator is meaningful and tells us something significant about the forest or forest management.
4. The indicator can be used to monitor trends over time.

GATHERING DATA

Initial assessment

All of the indicators included in the initial set were ones for which there already existed reasonably good data. For each indicator selected, there was an initial assessment made of the specific units of measure, the scale and measurement interval, the source of the information, and the lead agency responsible for gathering the data for the Model Forest. In this way, an initial assessment of data availability was part of the initial indicator screening process.

EXPERIENCE GAINED — A PRACTICAL WORK PLAN

Based on its experience, the Eastern Ontario can recommend its approach, which was to start small and produce a first State of the Forest without waiting for perfect data to be available. The process of selecting indicators was a good one, although perhaps there could have been more attention paid to the so-called "critical elements" (the sub-criteria in the CCFM framework), even though not as much attention was being focussed on these critical elements at the time.

Roles and responsibilities

Each indicator in the initial "starter set" of indicators had a lead agency identified. In most cases, the Eastern Ontario Model Forest was identified as the lead agency to actually gather the data although the source had already been identified and in many cases other agencies were listed as offering to provide assistance. In order to actually do the work of gathering all of this information, the Model Forest contracted a consultant to complete the first State of the Forest Report. Work was carried out beginning in October 1998 with the report completed in March 1999.

Current status

In order to assist the Forest Science Committee in refining and improving upon its first State of the Forest Report, the Model Forest commissioned an independent review of the report. That review included recommendations on which indicators should be kept, added or dropped in future reports, as well as ways to improve the quality of the information gathered for several indicators. The report (still in draft form) will help to guide the future priorities of the Forest Science Committee.

Ongoing monitoring

This is an aspect that requires further discussion. The role of Eastern Ontario Mapping and Information Services (EOMIS) needs to be clarified but it is anticipated that much of the information will come from this mapping unit. EOMIS is an initiative of the EOMF created to provide geographic information in the most useful and up-to-date form possible to a broad clientele including landowners, resource managers, planners, foresters, farmers, recreational facilities, consultants and businesses.

EXPERIENCE GAINED — GATHERING DATA

One of the key challenges of the Eastern Ontario Model Forest will be to obtain adequate information on forest cover and quality. This gap in information represents a current challenge to state of the forest reporting.

USING AND REPORTING ON INDICATORS

State of the Forest Report: This has been the first concrete outcome of the LLI initiative. It is to be used to fulfill the first two objectives of the Model Forest's LLI work (as described in section "B" above). It is the first systematic attempt to monitor the overall state of forest health and sustainable forest management in eastern Ontario. The Model Forest recognizes that there are gaps and shortcomings in that assessment and will be working to refine and improve upon its assessment. At the same time, the report is a good basis for communicating to the general public about the significance of the forest and the breadth of the concept of sustainable forest management. Two plain language companion documents to the State of the Forest Report have also been produced in recent months.

Management planning and future visioning: The State of the Forest Report provides a broad overview of the current state of the forest and sustainable forest management. The Eastern Ontario Model Forest is now ready to use that information as a base to develop a vision of the desired future forest, and what must be done to achieve that vision.

Certification: The Eastern Ontario Model Forest is embarking on a project that will assist woodlot owners in the area to have their holdings certified to the requirements of the Forest Stewardship Council. It is anticipated that the work done to date on local level indicators will help in meeting the monitoring requirements.

NEXT STEPS

The analytical review of the State of the Forest Report by P. Duinker and K. Saunders (in draft form) has identified weaknesses in the report and provided recommendations for improvement. It has identified indicators to be retained, deleted, and added to ensure that the 17 elements within the CCFM Framework are well represented. A workshop with partners will be convened in 2000-2001 to consider plans for future state of the forest reports in light of the recommendations put forth in the analytical review. The specific role for Eastern Ontario Mapping and Information Services will also be developed over the next year. The plan is to prepare a second State of the Forest Report which will include LLI reporting as well as additional information on important issues.

The analytical review has also identified the need to obtain an up-to-date forest resource inventory. This will be another priority for the EOMF in the coming year.

Publications and reports

Barkley, Brian, Jim Cayford, Sandra Lawn and Cathy Nielsen. 1999. *Local Level Indicators of Sustainable Forest Management in the Eastern Ontario Model Forest: A Progress Report on the First Two Years 1997–98 and 1998–99.* Eastern Ontario Model Forest, Information Report No. 44. 5 pgs.

Johnson, Lorne and Paul Heaven. 1999. *The Eastern Ontario Model Forest's 1998–1999 State of the Forest Report.* Eastern Ontario Model Forest, Information Report No. 42. 88 pgs.

Keddy, C. 1994. *Forest History of Eastern Ontario.* Eastern Ontario Model Forest, Information Report No. 1. 41 pgs.

Keddy, P. and C. Drummond. 1995. *Ecological Properties for the Evaluation of Eastern Ontario Forest Ecosystems.* Eastern Ontario Model Forest, Information Report No. 13. 27 pgs.

Riley, L. F. 1997. *A Review of Some Current Sustainable Forest Management Initiatives in Canada and Implications for the Eastern Ontario Model Forest, and A Brief Analysis of the CCFM Criteria and Indicators Framework and its Application in the Eastern Ontario Model Forest.* Eastern Ontario Model Forest, Information Report No. 33.

von Mirbach, Martin and Lorne Johnson. 1998. *Local Level Indicators for the Eastern Ontario Model Forest.* Eastern Ontario Model Forest, Unnumbered Report. 55 pp plus appendices.

1999 State of the Forest Report — Summary. 1999. Eastern Ontario Model Forest. 12 pgs.

Measuring Forest Sustainability — An Introduction. 1999. Eastern Ontario Model Forest. 8 pgs.

Further information

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TABLE 3.7: LOCAL LEVEL INDICATORS OF EASTERN ONTARIO MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent and amount of area forested	ha forested	county	5 yrs	OMNR / EOMF	•Some ground truthing required for small specific areas •Historical records to 1880.
Amount and percentage of interior forest space	•Hectares than 100m from perimeter •Percent of total forest area	county	5 yrs	Ontario Hydro OMNR / EOMF	—
Identification and protection of local sites of significance	•ha and % in IUCN categories I, II, III, IV, and V •# of ANSIs	EOMF / county	—	Dendron 1994; OMNR	—
Number of known species classified as extinct, endangered, threatened or vulnerable	Names of species	EOMF / county	Ongoing	OMNR "Natural Heritage Information Centre"	—
Population levels and changes over time of selected species	# of species increasing and decreasing	EOMF	5 yrs	Cadman et al. 1998	—

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Natural disturbance and stress	•Severity of ice storm damage, by species •ha defoliated by insects	EOMF	Annual	OMNR / CFS	
Forest stand health	•Mean-decline index of sugar maple •% of crown dieback	EOMF / study sites	Annual	CFS / MOE / OMNR	

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percentage of riparian areas with natural vegetation cover.	%	County	5 yrs.	Ontario Hydro EOMF / OMNR	—
Buffering capacity and soil acidification	exceedence levels	Stand	Annual	CFS Health plots also (Hall, P., Bowers, W.,Hirvonen, H., 1998)	—

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

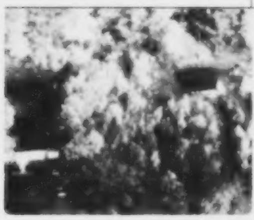
Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Ground level ozone and pollution deposition	descriptive	EOMF	Annual	CFS / Environment Canada	—
Climate trends	descriptive	EOMF	—	—	—

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Production of timber forest products	Volume (of sawlogs and pulpwood) purchased	EOMF	Annual	Mill license returns to OMNR & Maple Syrup Producers	•1998 figures
Regional wood prices	Dollars, by species	EOMF	Annual	Ontario Forestry Assoc. bulletin	•1998 figures
Employment in forest-related sectors	•# of people employed, by category •% change from 1991–1996 •Ratio of forestry employment to total employment	EOMF	5 yrs	Statistics Canada	—

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Community involvement in sustainable forest management	•Presence of municipal tree cutting by-laws •Municipal handling of significant woodlands •Local governments with greening programs	County	3–5 yrs	EOMF / Questionnaire	—
Private land management and conservation practices	•Participation in CLTIP •% of survey respondents with a management plan •% usage of different harvesting methods	EOMF	Annually or 3–5 yrs	CLTIP — OMMAH Woodlot Mgmt. OWA Survey	—
Participation in forest education and outdoor recreation	•Employment statistics for graduates •Park visitation •School group visits •Camper nights	EOMF	1–5 yrs	EOMF Partners & Survey	—
Mutual learning mechanisms	Descriptive	EOMF	Ongoing	EOMF	—



ABBREVIATIONS

ANSI:	Area of Natural and Scientific Interest
MOE:	Ministry of the Environment
CFS:	Canadian Forest Service
OMMAH:	Ontario Ministry of Municipal Affairs and Housing
CLTIP:	(Ontario) Conservation Land Tax Incentive Program
OMNR:	Ontario Ministry of Natural Resources
EOMF:	Eastern Ontario Model Forest
OWA (Survey):	Ontario Woodlot Association
IUCN:	International Union for the Conservation of Nature

Lake Abitibi
Model Forest

This Model Forest is the only one situated in a claybelt which gives it a unique landscape and presents a number of management challenges.

LAKE ABITIBI MODEL FOREST

BACKGROUND

The Lake Abitibi Model Forest is a 1.2 million-hectare area in the northeast corner of Ontario bordering on the province of Québec. It is located north of Kirkland Lake and east of Cochrane. This Model Forest is the only one situated in a claybelt which gives it a unique landscape and presents a number of management challenges.

The tree species found in this part of the boreal forest are black spruce (the most dominant species in the area), white spruce, balsam fir, jack pine, white birch, and poplar. Approximately 95 percent of the area is Crown land consisting of a sustainable forest license (SFL) held by Abitibi-Consolidated as well as a number of parks and protected areas.

At present, 28 partners are working on a variety of innovative research programs providing important data about the effects of forest management activities on the survival, growth, and quality of the forest, and the sustainability of local communities. An extensive inventory has been performed on the cultural heritage of the area in association with local communities and First Nations. Studies of the area's birds, mammals, and aquatic life have also been undertaken.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

When the Lake Abitibi Model Forest launched its local level indicators program in 1997 there were already a number of related initiatives underway in the region. Abitibi-Price, the Model Forest's major industrial partner (now Abitibi-Consolidated), was developing indicators as part of its efforts toward obtaining independent forest certification. At the same time, the Ontario Ministry of Natural Resources was developing a list of indicators suitable for use in the management of the boreal forests of northern Ontario.

PLANNING
and

ANIFICATION ET

Initial purpose

The Lake Abitibi Model Forest viewed the development of a suite of local level indicators as an opportunity to demonstrate the innovation and expertise consistent with their goal of being a leader in the sustainable management of claybelt forests. To facilitate this development, the Model Forest decided to approach this challenge in three steps: educating its partnership about Criteria and Indicators, developing appropriate local level indicators, and using those indicators to demonstrate sustainability.

Getting started on the work program

For the initial stages of the process, the General Manager was charged with the responsibility of generating the list of indicators. A committee was established to act in an advisory role to guide the indicator development process and provide input into the applicability of the indicators to the local situation.

For the purpose of evaluating local level indicators and determining their applicability, an identification of the various forest values held by all concerned and affected groups was performed. The Model Forest staff developed an initial set of values based on a wide variety of source material: a public survey, Model Forest projects from 1992–1997, industry management plans, a wilderness tourism strategy for the region, the government forest management planning manual, and the Ontario Forest Industry Association's Code of Forest Practises. This report was completed in February 1998. Activities since then have been based on a field-test of a variety of indicators which built upon the original local level indicators work at the Lake Abitibi Model Forest.

LESSONS LEARNED — GETTING STARTED

Many challenges have been encountered throughout the indicator development process. It was difficult initially to know where to begin since so many different approaches were possible. With many different projects on the go, it was also difficult to push the process along as quickly as desired.

SELECTING INDICATORS

Initial indicators

The Lake Abitibi Model Forest initially adopted the Canadian Council of Forest Ministers' criteria and critical elements. However, it was agreed that these would be used only as a guide and that the indicators would be subjected to the same screening process applied to those from other sources. Through a variety of evaluation exercises, significant changes have been made to the initial set of indicators to better reflect the local situation.

The selection of an initial list of indicators was done in several ways. In 1997, a graduate student from the University of Toronto compiled a preliminary list of indicators that could be derived from various company records (management plans, etc) held by Abitibi-Price (Consolidated). Concurrently, a list of indicators was developed at three workshops of government and industry representatives organized by the Forest Ecosystem Science Co-operative (FESC). The FESC is a provincial-level organization of which the Model Forest is an active member. The preliminary screening of the proposed indicators was completed in January 1998. Subsequently, the selected indicators were subjected to field-testing and further refinement.

The Socio-Economic Program Committee of the Model Forest has also approached the topic of indicators in their strategic plan. A set of indicators of economic stability were developed and reported on in February 1999 by consultants who conducted a socio-economic analysis of the Model Forest.

INDICATOR SCREENING CRITERIA

1. Relevance
2. Measurability
3. Responsiveness to management actions
4. Predictability

Refining the indicators

A consulting team developed a screening framework for analysis of the proposed indicators. This framework was used to reduce the initial set of indicators from 152 to 72. The screening criteria used by the consultants are listed in the sidebar.

Further testing and filling gaps

The same consulting team continued to work with the indicators refining them further through field assessment at two case-study sites, one of which was the Lake Abitibi Model Forest. Attempts were made to derive quantitative (or, in some cases, qualitative) values for the indicators and in doing so to determine whether the indicator was appropriate for use. In a report completed in March 1999, a set of 57 indicators was identified for further use. This list has been combined with that provided by the socio-economic project to give the list of indicators which are currently in the final assessment phase.

LESSONS LEARNED —
WORKING WITH OTHER AGENCIES

Working with the provincial Forest Ecosystem Science Cooperative was an effective approach for the development of local level indicators. It allowed an experienced third party to objectively assess indicators and tied the Model Forest's work into a provincial level project. Having two case study areas served to validate the broader applicability of many indicators. One pitfall was that the time lines for the FESC project did not correspond with the tighter deadlines faced by the Lake Abitibi Model Forest. Consequently, the Model Forest fell behind in its indicator development process.

GATHERING DATA

Initial assessment

The further refinement of indicators described above included an initial assessment of the data that are available for each indicator. Since the FESC report was prepared, Abitibi-Consolidated has completed their forest management plan for the 2000–2020 period. As such, much of the information that was not previously available (because it was in the process of collection and compilation) can now be accessed and reported on.

Roles and responsibilities

The Model Forest's Local Level Indicators Committee has assumed responsibility for developing a monitoring plan for the Model Forest. A Local Level Indicators Specialist was hired in April 2000 to lead in the development of this monitoring plan and to coordinate and carry out data collection, compilation, and reporting. This process will lead to the preparation of an initial State of the Forest report to be completed in the fall of 2000.

Current status

Data are currently being collected and compiled by a variety of organizations but they are very disjointed and do not cover the entire suite of indicators. As part of the forest management planning process, Abitibi-Consolidated is required to report on its annual and projected activities. A variety of indicators are used for this reporting. Similarly, the provincial government compiles information on several indicators related to wildlife management and other resource-related activities within the Model Forest. Socio-economic data are compiled by Statistics Canada in the *Census of Canada* and the local Chambers of Commerce and associated groups also maintain a variety of statistics. As such, the initial reporting efforts will require collecting information from these diverse sources and making it accessible in a single document.

Ongoing monitoring

Much of what needs to be measured for the Lake Abitibi Model Forest's local level indicators initiative is already being measured by a variety of organizations. For these indicators, the task for the Model Forest is one of information transfer rather than setting up a separate monitoring regime. However, there are gaps in the available data, especially in terms of measuring the extent of use and levels of satisfaction in non-industrial users of the forest. To address these gaps, the Model Forest's LLI Specialist will develop a comprehensive monitoring protocol to cover all of the selected indicators. Some gaps, such as the carbon budget of the forest, may be more difficult to fill with the resources and expertise available to the Model Forest and some indicators may be set aside for further research and development.

It is not certain at this time how the data related to the indicators will be stored. It will be necessary to negotiate with the various organizations that currently maintain these databases before such a determination can be made. It must also be determined whether the Model Forest will need to keep the raw data that are used in each report. There are several advantages to having the raw data but they may be difficult to obtain for proprietary reasons.

LESSONS LEARNED — GATHERING DATA

The hiring of a LLI Specialist has allowed this project to advance rapidly and in a better-coordinated fashion. The overall cost of hiring was reduced through a successful application for external funding assistance.

In terms of lessons that have been learned through the process, a good example is the survey of local community values. In hindsight, this survey should probably have been developed, administered, and analysed independently rather than being done in-house by the Model Forest. While it provided valuable information for the local level indicators development process, it may have been more valuable to conduct a survey that allowed statistical analysis and comparison with subsequent follow-up surveys. This being said, through this evaluation process, the Model Forest staff and partners have developed some expertise in the assessment of values and the development of indicators which has been valuable in the implementation of various projects.

USING AND REPORTING ON INDICATORS

Public awareness and understanding: In order to raise general understanding of criteria and indicators, the Model Forest prepared a series of short articles as part of its "Media Science Series". One article introduces the overall concept of criteria and indicators, followed by a separate article for each of the CCFM's six criteria explaining why that criterion is an important aspect of sustainable

forest management and discussing in a general way how indicators might be used to help assess this criterion. These articles were published in local newspapers over a 7-week period in 1998. This non-technical approach to explaining criteria and indicators has proven to be very successful and the information sheets have been adapted and used by several other Model Forests.

Scenarios/forecasts: As part of the forest management planning process, a variety of potential management scenarios/forecasts are modelled using provincially developed software. These focus primarily on the ecological aspects of the forest and on the flow of resources. It is expected that once baseline data have been collected on the suite of indicators, it will be possible to conduct modelling efforts designed to test different potential scenarios or to forecast future indicator levels based on a particular management action. The Model Forest has participated in such activities in the past in terms of modelling the socio-economic status of the local communities. One of its Phase I projects was the preparation of a Community Development Impact Model that can be used to test the impacts on the local communities of various development decisions.

Developing management plans: Currently, some of the indicators are being used in the management planning process. These are required by the *Forest Management Planning Manual for Ontario's Crown Forests* (the government planning manual). However, since data collection and compilation is in an early phase, the Model Forest's contribution to this process has been minimal. As well, these indicators are focussed primarily on the flow of resources and on ecological factors. It is possible that as data are made available on other indicators, they may be used in the management planning process.

Identifying targets or thresholds: Since the initial suite of indicators has not been completed, it has not been possible to set targets. However, once the initial baseline measurements are made and reported on, the intent is to develop targets where possible to guide management activities and to provide a measure of performance in terms of the move toward sustainable forest management.

Forest certification: In a separate but related development, Abitibi-Consolidated has been undergoing the ISO 14001 registration process for its management license comprising the Lake Abitibi Model Forest. It is expected that the local level indicators initiative will support this process by helping to demonstrate that an environmental management system is in place.

State of the Forest report: A monitoring and reporting schedule is currently in development for the local level indicators initiative. It is expected that reporting will take place every 5 years for the bulk of the indicators to allow sufficient time for trends to be observed. It is possible that a smaller annual report on selected indicators may be released but that is yet to be determined. A 5-year time period is thought to be best because it coincides with the forest management planning cycle and the Census of Canada. As such, it should provide a good snapshot of the condition of the forest and surrounding communities. The first State of the Forest Report is scheduled to be completed by the end of 2000.

NEXT STEPS

The top priority in the coming year is to complete the list of indicators and to conduct measurements for the starter set. Following this data collection, a State of the Forest report will be released in Fall 2000.

Publications and reports

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💿 Lake Abitibi Model Forest. September 1999. Sustainable Communities: *A Community Development Impact Model (CDIM).* Lake Abitibi Model Forest Project Information Note. 4 pgs.

💿 Plante, W. 1998. *A Non-Technical Look at Criteria and Indicators for Sustainable Forest Management* (seven articles about criteria and indicators). Lake Abitibi Model Forest Media Science Series. 15 pgs.

Wedeles C., J. Williams, P. Duinker, F. Doyon, D. Euler, and R. Carrow. January 1998. *Screening Analysis of Sustainable Forest Management Indicators.* ArborVitae Environmental Services Ltd. 53 pgs.

💿 Wedeles, C. and J. Williams. March 1999. *Assessment of Indicators of Sustainable Forest Management: Summary Report.* ArborVitae Environmental Services Ltd. 44 pgs

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TABLE 3.8: LOCAL LEVEL INDICATORS OF THE LAKE ABITIBI MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent & extent of area by forest type & age class	% of area, ha	LAMF	5	ACI	Recommended for report
Percent & representativeness of forest types in protected areas	% of area, ha	Site District	5	ACI	Recommended for report
Level of forest fragmentation and connectedness	Fragmentation indices	LAMF	5	ACI	Recommended for report
Number of species classified as vulnerable, threatened, endangered, extirpated, or extinct.	# of species	LAMF	1	COSEWIC / OMNR	Recommended for report
Population levels of vulnerable, threatened, endangered species	# of observations/ population indices	LAMF	1	OMNR / LAMF	Recommended for report
Adherence to seed zones	% of stock from correct seed zone	LAMF	1	ACI	Recommended for report
Size of parent population having produced regeneration	# of individuals	?	?	ACI	More investigation
Surface area and size distribution of areas located more than 1, 5, and 10 km from roads	ha	LAMF	1	ACI	Recommended for report

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area & frequency distribution of clearcuts by size	ha	LAMF	1	ACI	Recommended for report
Population levels of selected species	# of individuals or population indices	WMU / LAMF	1	OMNR / LAMF	Recommended for report
Habitat quality and quantity for selected species	Provincial rating system, km^2	LAMF	5	ACI / OMNR	Recommended for report
Area and frequency distribution of fire disturbance	ha	LAMF	1	ACI	Recommended for report
Levels of wind and other disturbances	% of area affected	LAMF	1	ACI	Recommended for report
Area of barren and scattered vs. free-to-grow managed forest land	ha	LAMF	1	ACI	Recommended for report
Success rate of natural and artificial regeneration	%, ha	LAMF	1	ACI	Recommended for report
Percent of depleted area successfully regenerated	%, ha	LAMF	1	ACI	Recommended for report
Area converted to/from forest land use	ha, % change over time	LAMF	1	ACI	Recommended for report
Quantity of forest products harvested by species and product	m^3/product or # of individuals harvested	LAMF/ WMU	1	ACI / OMNR	Recommended for report
Carrying capacity for economically important species	# of individuals	LAMF	1	ACI / OMNR	More investigation

continued on the next page

Criterion 2:
Maintenance and Enhancement of Forest Ecosystem Condition and Productivity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Allowable harvest level for economically important wildlife species	# of individuals	WMU	1	OMNR	Recommended for report
Planned & actual depletions by type by forest unit	ha, m^3	LAMF	1	ACI	Recommended for report
Silvicultural spending per year in the LAMF	$	LAMF	1	ACI	Recommended for report

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent of forest managed primarily for soil & water protection	% of area, ha	LAMF	1	ACI	Recommended for report
Changes in soil pools of available nutrient in recently harvested areas	?	?	?	?	More investigation
Chemical and physical structure of soil (pre- and post-harvest) on representative ecosites	?	?	?	?	More investigation
Proportion of catchment disturbed per decade by type of disturbance	% of area, ha	LAMF	10	ACI	Recommended for report
Water quality as measured by chemistry, turbidity etc.	?	?	?	?	More investigation
Number & significance of infractions related to riparian buffer zones	# of infractions/ penalty	LAMF	10	ACI / OMNR	Recommended for report
Distribution and abundance of aquatic fauna	?	?	?	?	More investigation

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Net primary productivity	kg of carbon / ha / day	eco-region	5	ACI / OMNR	Recommended for report
Tree and non-tree biomass	kg/ha	?	?	?	More investigation
Net carbon flux	?	?	?	?	More investigation
Mean Annual Increment by forest type and age class	m /ha/year	LAMF	1	ACI	More investigation

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Population	# of individuals, % change	Mun.	5	StatsCan	Recommended for report
Labour force	# of individuals, % change	Mun.	5	StatsCan	Recommended for report
Average household income	$, % change	Mun.	5	StatsCan	Recommended for report
Composition of income	% of total income from different sources	Mun.	5	StatsCan	Recommended for report
Incidence of low income	% of population	Mun.	5	StatsCan	Recommended for report
Education	% of population with various levels of education	Mun.	5	StatsCan	Recommended for report
Percent of economic base in forestry	% or total # of individuals employed	Mun.	5	StatsCan	Recommended for report

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Criterion 5:
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Labour force by industry	% or total # of individuals employed	Mun.	5	StatsCan	Recommended for report
Crown forest area available for timber production (by forest unit)	ha	LAMF	5	ACI / OMNR	Recommended for report
Capital expenditures in forest resource based businesses by sector	$	LAMF	1	ACI / OMNR / LAMF	Recommended for report
Stumpage rate and amount by species and product	$\$/\text{m}^3, \$$	LAMF	1	ACI / OMNR	Recommended for report
Value of timber and manufactured products from the forest, by product	$	LAMF	1	ACI / OMNR	More investigation
Economic value of consumptive goods and recreational activities provided by the forest (excluding timber)	$	?	?	ACI / OMNR / NOTO	More investigation
Value added	?	LAMF	?	?	More investigation
Non-consumptive forest-based recreational and tourism opportunities and use, by type of use & number of users	# of developed facilities, # of users	LAMF	1	LAMF	Recommended for report
Total expenditures by individuals on activities related to non-timber use.	$	?	?	?	More investigation
Economic value of intangible goods and services	$	?	?	?	More investigation

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Number and percent of Aboriginal communities in or adjacent to the LAMF involved in the special native consultation option	# of communities, %	LAMF	5	ACI / OMNR	Recommended for report
Extent of Aboriginal participation in forest-based economic opportunities	ha harvested, # of individuals involved by activity	LAMF	1	ACI / OMNR	Recommended for report
Extent of Aboriginal satisfaction with forest-based economic opportunities	Qualitative assessment	LAMF	1	ACI / OMNR	Recommended for report
Extent to which forest management planning takes into account the protection of Aboriginal social, cultural or spiritual sites	Qualitative assessment, # of identified sites protected	LAMF	5	ACI / OMNR	Recommended for report
Degree of public participation in decision-making	Qualitative assessment	LAMF	1	ACI / OMNR	Recommended for report
Local Citizen's Committee evaluation of its effectiveness	Qualitative assessment	LAMF	5	ACI / OMNR	Recommended for report
Quality of existing forest resource inventory	Qualitative assessment, actual harvest vs. inventory prediction	LAMF	5	ACI / OMNR	Recommended for report
Effectiveness of public education	Qualitative assessment	LAMF	1	LAMF	More investigation
Investments in forest-based research and development and information	# of projects, $	LAMF	1	ACI / OMNR / LAMF	Recommended for report

110
100
90
80
70
60
50
NORTH GRO

ABBREVIATIONS

ACI:	Abitibi-Consolidated Inc.
NOTO:	Northern Ontario Tourist Outfitters
COSEWIC:	Committee on the Status of Endangered Wildlife in Canada
OMNR:	Ontario Ministry of Natural Resources
LAMF:	Lake Abitibi Model Forest
WMU:	Wildlife Management Unit
Mun.:	Municipality

... activities in the area include tourism, mining and sport fishing

Manitoba
Model Forest

MANITOBA MODEL FOREST

BACKGROUND

The Manitoba Model Forest comprises 1.05 million hectares of boreal forest that stretches eastward from Lake Winnipeg to the Manitoba-Ontario border. The region has a long history of timber harvesting and continues to be the principal supply area for Pine Falls Paper Company, a major newsprint mill. Other activities in the area include tourism, mining and sport fishing.

The Manitoba Model Forest is a non-profit organization representing over 25 diverse forest interests. The Model Forest brings together environmentalists; industry; all levels of government; local communities, including First Nations; economic development groups; unions, universities; and Aboriginal organizations so that they may share knowledge and resources in their mutual quest for sustainable forests.

Current activities focus on ecosystem-based management, developing indicators of sustainable forest management, and mimicking natural disturbances such as fire by altering logging techniques and patterns. In three First Nations communities within the Model Forest, traditional Aboriginal knowledge, language and history are being recorded using digital cameras and Geographic Information Systems.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

Many projects carried out or supported by the Manitoba Model Forest in its first five years of existence have proven to be useful for its local level indicators initiative. Projects with particular relevance include caribou research resulting in a habitat suitability index model, fire history mapping, and the production of a soil compaction index. More generally, the Model Forest's work in developing research partnerships, conducting cross-cultural workshops, identifying stakeholders and carrying out consultation processes have all been extremely important in forging good relationships and helping to ensure that the Manitoba Model Forest has a good team of experts and interests that it has been able to call upon in its local level indicators initiative.

Initial purpose

The purpose of the Manitoba Model Forest's initiative on local level indicators is to provide a set of indicators for use in Pine Falls Paper's SFM-based management plan and to thereby contribute to the company's certification endeavours, while providing a framework for tracking issues of interest to Model Forest partners.

A workshop was held in April 1998 with fifty people in attendance from a wide variety of organizations. Participants identified some seventeen potential uses for C&I in Manitoba. Several of them are process-oriented (e.g., get everyone talking the same language), some are oriented towards specific products or deliverables (e.g., State of the Forest Reporting, assess existing guidelines and regulations), while others identify the potential long-term impact (e.g., achieve greater consensus on land use decisions east of Lake Winnipeg). Some specific indicators-related tasks were suggested as part of the Model Forest's LLI strategy.

Getting started on the work program

The April 1998 workshop also included an identification of values by all participants using the Canadian Council of Forest Ministers' criteria as a framework. The work begun at this workshop was then handed off to a Model Forest committee to carry forward. The initiative was led by Pine Falls Paper Company and included a consultant and a subgroup of the Model Forest Indicator Committee as well as some invited experts. This group matched and translated the values with the Criteria and Critical Elements of the CCFM framework. Draft indicators and targets were formulated. Tasks were assigned to the consultant.

EXPERIENCE GAINED — GETTING STARTED

- The CCFM had done a very thorough job in the development of their Criteria and Critical Elements as all values identified were easily equated in the framework.
- A good way to involve diverse stakeholders in the process is to start with a values identification process; this is especially useful in encouraging the effective participation of people who may not be technical experts or have scientific backgrounds.
- Special care needs to be taken around issues related to Aboriginal rights and treaties; at the beginning it's usually best to try and stick to basic values.
- Use of a neutral facilitator is recommended.
- Ensure all participants receive the results as soon after the values exercise as possible.
- Providing the raw notes from the workshop to participants before any massaging by a smaller group is also recommended.

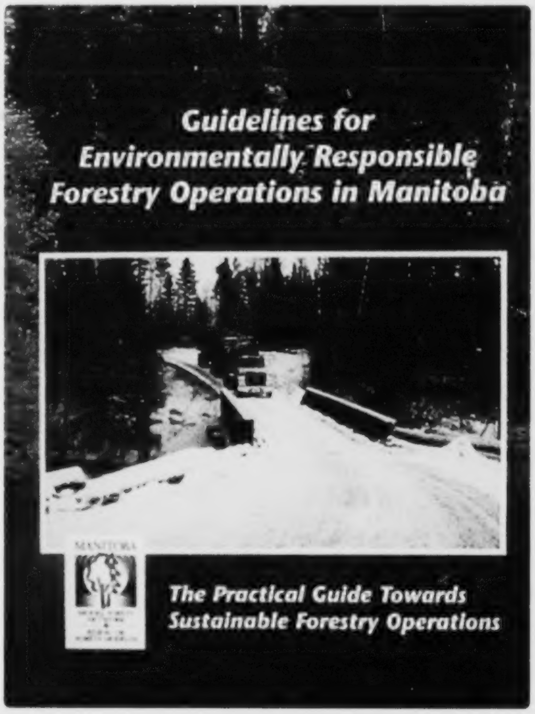
SELECTING INDICATORS

Initial indicators

The local level indicators committee translated the values identified at the April 1998 workshop into an initial set of goals, indicators, objectives and targets. They started with the proposed CCFM indicators and then considered information currently available or under preparation. This exercise took about six months but was not continuous work.

Refining the indicators

The initial set of goals, indicators, objectives and targets were then taken through a series of workshops based on particular criteria from the CCFM framework. People were invited on the basis of expertise to individual workshops. A refined set of goals, indicators, objectives and targets were



Guidelines for Environmentally Responsible Forestry Operations in Manitoba

MANITOBA

The Practical Guide Towards Sustainable Forestry Operations

produced. The results were then put on an Internet site for further input, although little input was received through this method. The major criteria used to screen indicators was whether or not information was available or readily obtainable.

Further testing and filling gaps

The indicators were carefully evaluated during the screening process and it was not felt necessary to formally "field-test" them. Pine Falls Paper Co. Ltd. took the goals, indicators, objectives and targets and developed a Monitoring and Reporting System as part of their ISO process. Responsibilities for indicator monitoring and reporting have been assigned to various staff. Some indicators have been identified as needing further research and development. Workshops will be held in the coming year to concentrate on the indicators that require further development and to help plan future research needs.

GATHERING DATA

Initial assessment

Assessment is on-going as the data is being pulled together.

Roles and responsibilities

A monitoring plan is currently being prepared by the Pine Falls Paper Planning Team as part of their ISO process. The Divisional Forester has overall responsibility for the monitoring program and assigns work to various staff. A GIS management information system is under development and it is anticipated that the system will incorporate most data management needs for indicator tracking.

Current status

Pine Falls Paper Company is currently compiling data.

Ongoing monitoring

Pine Falls Paper Company will have responsibility for ongoing monitoring and reporting.

EXPERIENCE GAINED — MONITORING RESPONSIBILITIES

The Manitoba Model Forest took the view that it should not take on any responsibilities that required long term commitment, in part because the long term future of the Model Forest Program is not guaranteed beyond 2002 and also because the Model Forest is not the landowner or the agency responsible for making management decisions. The Model Forest's role is as a support program assisting with facilitation, workshops, research and public involvement.

USING AND REPORTING ON INDICATORS

Setting targets: At the time that indicators were selected there were also targets identified for specific indicators. These were developed by a core group led by Pine Falls Paper Company with draft results discussed at four expert workshops in the fall of 1998. Workshop participants provided input although the core group retained ultimate responsibility for determining the actual target levels. Some target levels are still in development.

Management planning: Pine Falls Paper Company is in the process of developing a ten-year forest plan. The goals, indicators, objectives, targets and monitoring plan are central to the plan and along with

their operating procedures become the method for achieving and moving towards sustainability. Modelling and forecasting will be done as part of the planning process.

Forest certification: Along with the forest plan, the goals, indicators, objectives and monitoring plan are part of the company's ISO process.

Reporting: Depending on the indicator, reporting will be done either annually or periodically (five years).

EXPERIENCE GAINED — BROADER APPLICATION

Taking the indicator approach to forest planning was a new initiative for Manitoba and will be subject to public hearings in the future. After a number of discussions between Pine Falls Paper Company and the province, the guidelines for forest planning and environmental impact assessment were drafted by the province to include indicators. This a major accomplishment for the Manitoba Model Forest, with significant policy implications.

NEXT STEPS

In the coming year the Manitoba Model Forest will review the goals, indicators, objectives and monitoring plan in a workshop format to identify gaps, decide on future research needs, and assign responsibilities for data collection, monitoring and reporting.

Publications and reports

Manitoba Model Forest. April 1998. Criteria and Indicators Workshop, April 1998, Winnipeg, MB: Notes and Overheads.

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Trapline Experience
Maple Syrup Workshop Series

TABLE 3.9: LOCAL LEVEL INDICATORS OF MANITOBA MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent and extent of area by forest type and age class	Hectares	FML	3–5 yrs	Provincial Inventory; PFPC Records	•New provincial inventory underway
Composition of the forest in terms of Forest Ecosystem FEC V-types	Hectares	FML	3–5 yrs	Provincial FRI; PFPC Records; Conversion Program	•As above
Proportion of each Eco-region in protected status	Percent, hectares	Eco-region	Annual	Province	—
Patch-size distribution by natural disturbance type by landscape unit by age class	To be developed	FML	To be developed	To be determined	•5 yr development process
Nature of patch size and shape resulting from harvesting approximating natural landscape patterns	To be developed	FML	5 yrs	To be determined	•To be developed by 2005 •Max. 100 ha. cut over
Abundance and composition of residual stand structure	m^3/hectare	FML	To be determined	PFPC	•Target 3–5%
Density of roads	Hectare/km^2	FML	Annually	PFPC	•Target to be set
Percent of proposed harvest blocks subject to pre-harvest assessment	% hectares (sample)	Operating Area	Annually	PFPC	•Target — 100%

continued on the next page

Criterion 1

Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Proportion of pre-harvest assessment crews trained in the recognition / identification of VTE species and habitat	Crews trained	—	Annually	PFPC	•Target — 100%
Proportion of identified VTE for which appropriate management action have been taken	# Sites	FML	Annually	Province (PFPC)	•To be determined by 2002
Habitat quality and quantity for selected species	Habitat units	FML	5 yrs	FRI & Habitat Models	•6 species selected
Number of habitat units for the winter range of Owl Lake Woodland Caribou herd	Habitat units	Habitat Range	Annually	FRI & Habitat Models	•Target — Maintain ?
Continued partnership in the Integrated Forestry / Woodland Caribou Management Committee	Descriptive	N/A	Annually	PFPC	—
Adherence to seed zones	Descriptive	FML	Annually	Province	•Target — 100%
Utilization of commercial tree genetic material in tree propagation	Descriptive	FML	Annually	Province	•Target — 100%
Distribution of commercial tree establishment from provincial tree improvement sources, natural seed collection within seed zone and regeneration from local site seed source	Descriptive	FML	Annually	Province / PFPC	•Natural Regen. >25% •Art. Tree Improv. <25% •Art. Seed <50%

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area and severity of insect infestations	Hectares	FML	3–5 yrs	Province	•Reduce 10 yr avg. of severe
Areas recommended for treatment from MNR insect surveys	Descriptive	FML	Annually	Province	—
Area and frequency distribution of fire damage	Hectares	FML	Annually	Province	•Target — Reduce 10 yr avg.
Level of productive forest salvage harvested in insect and disease infected areas	Hectares	FML	Annually	PFPC	—
Fire detection and suppression success	# of fires detected <0.5 ha's	FML	Annually	Province	—
Harvested area successfully reforested & certified as achieving site renewal objectives at the 7 yr Regen. Survey	Hectares	FML	Annually	Province / PFPC	—
Harvested area successfully reforested and certified as achieving site renewal objectives at 14 year FTG survey	Hectares	FML	Annually	PFPC	•Target to be set
Mean annual increment and current annual increment by forest type and age class	m^3/ha/yr	FML	Annually	PFPC	•Initiate PSPs by 2001

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Loss of gross productive forest land base	ha/km^2	Watershed	Annual	PFPC	•Target to be set
Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss or organic matter, etc	% area	FML	Annual	PFPC	•Targets set
Exposure of ground surface adjacent to waterbodies which could result in impairment of water quality	Descriptive	FML	Annual	PFPC	•Target — 100% •Compliance with guidelines
Percent of gross productive forest area in recently disturbed condition (within 7 years of harvest and/ or fire) i.e. harvested and / or burned	Hectares	Watershed	Annual	PFPC	•Target < or = 30%
Areas significantly disturbed as a result of increases / decreases in water levels	Hectares	FML	3–5 yrs	PFPC	—
Retention of soil nutrient sources on site in the form of tree limbs and tops left from logging activity	Hectares	FML	Annual	PFPC	•Target — 100%
Percentage of potentially erodible sites treated according to SFPOP guidelines	Hectares	FML	Annual	PFPC	—
Harvested areas successfully reforested and certified as achieving site renewal objectives at 7 year regeneration survey	Hectares	FML	Annual	PFPC	—

continued on the next page

Criterion 3
Conservation of Soil and Water Resources — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent of forest managed primarily for soil and water protection	Hectares	FML	Annual	PFPC	—
Provincial and federal procedures, approvals, permits and licenses	Descriptive	FML	Annual	PFPC	—
Disciplinary actions	Descriptive	FML	Annual	Province / PFPC	—
Number of reportable spills	Descriptive	N/A	Annual	PFPC	—
Ratio of surface water to land surface	ha's or km^2	FML	3-5 yrs	PFPC	—
Area significantly disturbed as a result of increase/ decrease in water level	Hectares	FML	3-5 yrs	PFPC	—
Area of forested and non-forested land	Hectares	FML	Annual	PFPC	—
Current annual growth of productive forest	MAI	FML	Annual	PFPC	—
Production of recycled pulp from de-inking plant	Metric tonnes/ day	N/A	Annual	PFPC	—
Level of fuel usage	% / m^3 wood harvested	N/A	Annual	PFPC	—
Area of forested & non-forested land on FML 01 converted to permanent roads	km^2 / km^2 of total landbase	FML	Annually	PFPC	—
Area of forested land	Hectares	Agricultural lands	3-5 yrs	PFPC	—

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Annual removal of timber relative to volumes deemed sustainable	m^3	FML	Annual	Province / PFPC	—
Sustainable wildlife habitat units	Habitat suitability units	FML	5 yrs	Province / PFPC	—
Volume of standing timber to which appropriate road access has been developed	# yrs of supply accessed	FML	5 yrs	PFPC	—
Return on capital employed	Return on investment	N/A	Annually	PFPC	—
Capital investment on a long term basis	% earnings towards capital investment	N/A	Annually	PFPC	—
Ranking with respect to cost of delivered wood	# in ranking for central Canada	Central Canada	Annually	CPPA	—
Issues identified and dealt with	# of issues	FML	Annually	PFPC	—
Consultations with potentially affected forest-based industries	# and descriptive	FML	Annually	PFPC	—
Number and value of contracts awarded to enterprises in the area	Numbers & dollars	FML	Annually	PFPC	—
Offers of economic opportunity to FML communities	Numbers	FML	Annually	PFPC	—

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Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Expenditures or payments of the Company to residents, businesses and governments	Dollars	PFPC	Annually	PFPC	—
Road management plan in place	Descriptive	FML	Annually	PFPC	—
Include identified special use areas and areas of concern into planning processes as they are brought forward during joint planning with First Nations and other public consultation processes	Descriptive	FML	Annually	PFPC	—
Number of jobs resulting from on-going operation of PFPC	# of jobs	FML & Mill	Annually	PFPC	—

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Meet provincial and federal legislation requirements	Descriptive	N/A	Annually	PFPC Prov. / Feds	—
PFPC staff participating in awareness workshops	Descriptive	N/A	Annually	PFPC	—
Profitability of PFPC operation leading to sustainable employment levels	Return on Investment	N/A	Annually	PFPC	—
Value of forest management contracts awarded to all local enterprises	Dollars	Eastern Manitoba	Annually	PFPC	—
Consultations with local community business organizations, individual enterprises and local elected officials regarding PFPC activities	Descriptive	N/A	Annually	PFPC	—
The establishment of community development strategies where PFPC would participate in joint planning	Descriptive	FML	Annually	PFPC	—
On going community consultation	Descriptive	N/A	Annually	PFPC	—
Variety and participation levels in forums for public involvement	Various — Descriptive & Quantitative	N/A	Annually	PFPC	—
Issues identified and dealt with at the community level	# of issues identified and resolved	N/A	Annually	PFPC	—

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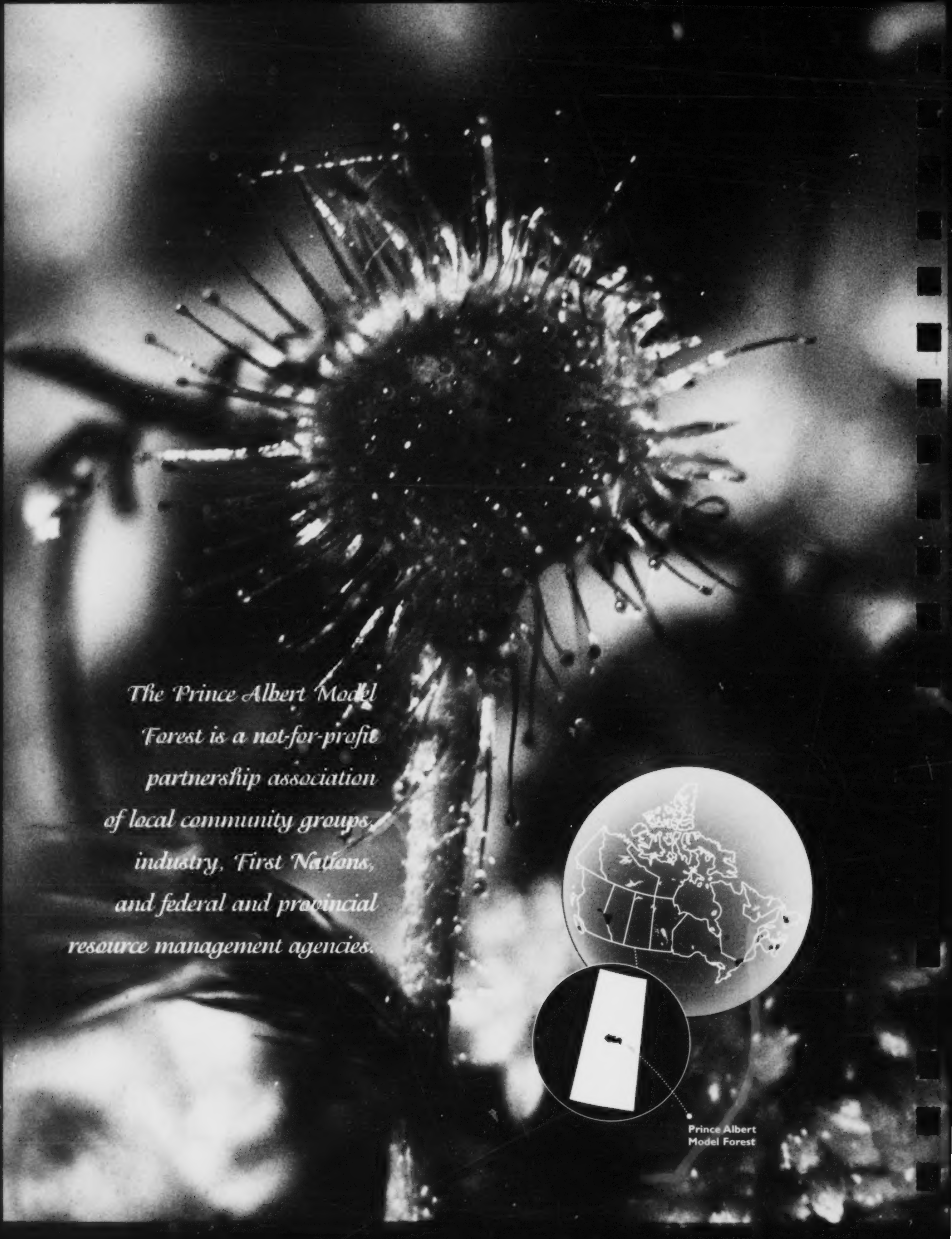
Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Consultation early in the planning process	Descriptive	N/A	Annually	PFPC	—
Research partnerships and projects undertaken by PFPC with government and others	Projects & funding level	N/A	Annually	PFPC	—
Participation in and creation of public information on forests	Descriptive	N/A	Annually	PFPC	—
Communities that have provided TEK to the SFM process while respecting the proprietary nature of TEK	Descriptive	N/A	Annually	PFPC	—
Available and timely forest information on which to plan and operate and assess achievement of targets	Variety of database surveys & audits	FML	3-5 yrs	PFPC & Province	—
A monitoring program for FML 01 that covers established Indicators and targets	N/A	FML	Annually	PFPC & others to be determined	—
Opportunities to meet and discuss SFM	Descriptive	N/A	Annually	PFPC	—
Training and on-going forest education, related to implementation of SOP	Descriptive	N/A	Annually	PFPC	—

ABBREVIATIONS

CPPA:	Canadian Pulp and Paper Association
FEC V-types:	Forest Ecosystem Classification vegetation types
FML:	Forest Management Licence
FRI:	Forest Resource Inventory
MAI:	Mean Annual Increment
MNR:	Ministry of Natural Resources
PFPC:	Pine Falls Paper Co.
PSPs:	Permanent Sample Plots
SOP:	Standard Operating Procedure
TEK:	Traditional Ecological Knowledge
VTEL:	vulnerable, threatened, or endangered


Prince Albert
Model Forest

The Prince Albert Model Forest is a not-for-profit partnership association of local community groups, industry, First Nations, and federal and provincial resource management agencies.

PRINCE ALBERT MODEL FOREST

BACKGROUND

The Prince Albert Model Forest covers 367,034 hectares in central Saskatchewan. It is located 72 km north of Prince Albert within the mixed-wood section of the southern boreal forest.

A significant portion, approximately 47%, of the Model Forest is an active part of Weyerhaeuser Canada's Forest Management Licence Agreement area. Ecosystem Management Areas include the Prince Albert National Park and Candle Lake Provincial Park.

The Prince Albert Model Forest is a not-for-profit partnership association of local community groups, industry, First Nations, and federal and provincial resource management agencies. The 10 partners involved in the Prince Albert Model Forest have formed working groups that carry out a wide range of activities related to ecosystem health and local level indicators of sustainable forest management suited to local socio-economic, cultural and environmental conditions.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior Activities

At the time that the Prince Albert Model Forest began the process of identifying indicators, there were already several other indicators-related processes underway in the region. Prince Albert National Park was developing its own set of indicators to be used in a report on the state of the park. Weyerhaeuser had identified a need to use indicators for monitoring programs established as part of both their forest management planning process as well as environmental impacts assessment. A Task Force of industry and the provincial government was getting started with its own indicators program.

INITIAL PURPOSE

The Prince Albert Model Forest identified a need and an opportunity to provide assistance in the initiatives mentioned above, especially in filling gaps and testing protocols. The Model Forest maintains working groups on Integrated Resource Management, Ecosystem Health/Local Level Indicators, and Communications and Knowledge Exchange. The local level indicators working group feeds information to these other working groups which in turn have the opportunity to input into the work of the LLI committee. In this way the Prince Albert Model Forest's local level indicators work is integrated with all of its work plan activities. One example of this integration will be for the local level indicators to be used to monitor the implementation of the Prince Albert Model Forest's Ecosystem Based Integrated Resource Management Plan.

GETTING STARTED ON THE WORK PROGRAM

A local level indicators working group was formed including representation from the Prince Albert Grand Council, Weyerhaeuser, Prince Albert National Park, Canadian Forest Service, Canadian

Institute of Forestry and Saskatchewan Environment and Resource Management (the provincial government). An initial workshop was held in March 1998 with about 35 people participating from a wide variety of agencies. This helped to familiarize participants with some of the core concepts and began to explore ways in which indicators could be used to link up to the objectives, goals and values that would be part of a management plan.

The Model Forest hired a person to work on the development of a suite of indicators for the model forest. This resulted in a report with a broad scope including information from the Canadian Council of Forest Ministers' Criteria and Indicators initiative, the C&I report from the National Aboriginal Forestry Association (NAFA), a report from the Western Newfoundland Model Forest, and the criteria and indicators from the provincial Forest Management Effects Monitoring Program.

EXPERIENCE GAINED — GETTING STARTED

The intent is to monitor progress towards goals and objectives and to use this information to improve management practices and to identify issues with respect to the original goals and objectives. Because the management plan for the model forest had not been developed, the Model Forest looked to the CCFM and provincial C&I processes for guidance.

SELECTING INDICATORS

Initial indicators

In 1997, the Prince Albert Model Forest created an initial list of indicators based on their goals and objectives. Initially, 162 indicators were selected, pulled from all the sources mentioned in the above report as well as incorporating the results of consultation with the Prince Albert Model Forest partners.

Refining the indicators

A consultant was hired to take the initial list of 162 indicators, select a reduced list of 33 potential indicators, and then analyse each indicator with respect to its ecological, social, cultural, economic, and practical value. The indicators were ranked and scored and a refined list of 17 indicators resulted from this process.

INDICATOR SCREENING CRITERIA

1. Ecological significance
2. Societal value
3. Public comprehension
4. Current knowledge
5. Sensitivity to disturbance
6. Measurement efficiency

The Local Level Indicators Working Group members felt the scoring and ranking process did not fully address the values of the Prince Albert Model Forest partners. The Working Group decided to review the list of 33 indicators as presented in the consultants report. The Working Group clarified, deleted and added indicators based on discussions at meetings and partner communications. A set of seventeen different indicators were identified that better reflected the goals, objectives and values of the Prince Albert Model Forest.

Further testing and filling gaps

A workshop was held in October 1998 in order to focus on developing and using socio-economic indicators. The workshop provided an overview of community sustainability in model forest communities. Participants included representatives from the Canadian Institute of Forestry, Saskatchewan Environment and Resource Management, Canadian Forest Service, and the Prince Albert Model Forest. As a result of the workshop, the Prince Albert Model Forest was presented with a project proposal to identify locally defined indicators of community sustainability for the communities of the Prince Albert Model Forest. The findings from this study are presented in the report "Locally Defined Indicators of Sustainability for Selected Human Communities in the Prince Albert Model Forest" (John Parkins, Canadian Forest Service).

A project was undertaken with the Foothills Model Forest to evaluate the potential elements and protocols to be used in monitoring and assessing aquatic health. The study was carried out by the Alberta Research Council.

Another project to look at indicators of effective public participation was undertaken with a private consultant. The report identified indicators and a process for monitoring them to ensure we are effective and efficient in our public participation and consultation activities.

EXPERIENCE GAINED — SELECTING INDICATORS

Local level indicators are and should be an integral part of a larger adaptive management process. The indicators chosen should reflect the goals and objectives set out in a management plan. Therefore it is vitally important to make sure the indicators answer or provide part of the answer to a management question, are measurable on the ground, and are cost effective.

GATHERING DATA

Initial assessment

The Working Group determined which partner had information on which indicator and arranged with the partner to have the data provided to the Model Forest. Some indicators have no existing data available for them so the first measurement of them will provide a baseline.

Roles and responsibilities

The list of refined indicators was reviewed with respect to their applicability to the partners. Each indicator was "adopted" by a partner ensuring it would be supported beyond the life of the Model Forest.

Current status

A time schedule for reporting on the indicators was developed and is currently being implemented.

Ongoing monitoring

The Local Level Indicators Working Group decided to carry out monitoring activities in the field that would benefit the partners and provide information on the Model Forest area itself. A field season was planned which focussed on testing the protocols designed through the provincial Forest Management Effects Monitoring Program. This included the establishment of six Permanent Ecological Sample Plots in the Model Forest area, the testing of the aquatic health sampling protocols based on benthic macro-invertebrates, a project to test the use of new microphone technology to record neo-tropical song-birds for later identification, and the testing of a sampling protocol for assessing effects of forest management on the physical properties of soils. A national project to examine the incorporation of naturalized knowledge into the national C&I was coordinated by the Prince Albert Model Forest. A position was developed to coordinate and summarize the results of the work carried out during the season.

EXPERIENCE GAINED — EFFECTIVE MONITORING

The Local Level Indicators Working Group has learned that local level indicators are best used to monitor the progress towards particular goals or objectives, preferably ones that are set out in an integrated resource/forest management plan. They are intended to provide information on how to modify current forest management practices if these practices are not achieving the desired goals or objectives. The intent should not be to monitor the indicators for the sake of monitoring. Too often the focus on monitoring lacks direction.

USING AND REPORTING ON INDICATORS

Management planning: The Prince Albert Model Forest anticipates using the Local Level Indicators framework for monitoring the implementation of the Ecosystem Based Integrated Resource Management Plan based on established goals and objectives and targets and thresholds. One outcome is to report on progress towards the goals and objectives; and the other will be to use the resulting information to improve management practices.

Incorporating naturalized knowledge in management planning: The Prince Albert Model Forest is interested in finding ways to better incorporate naturalized knowledge, including both Aboriginal knowledge as well as the local knowledge of long-time non-Aboriginal residents, into management plans. Indicators are seen as one way of doing this.

NEXT STEPS

Over the next year, the Prince Albert Model Forest will focus on two areas:

1) Collecting, compiling and analysing the data associated with the suite of 17 indicators.
2) Applying the appropriate indicators to a study on the effects of forest management activities in a riparian zone.

Publications and Reports

Golder Associates Ltd. April 1999. *Evaluation of Criteria and Indicators for Forest Ecosystem Monitoring in the Southern Boreal Forest Ecozone*. Golder Associates Ltd., 65 pgs.

Parkins, John, Jeji Varghese, and Richard Stedman. February 2000. *Locally Defined Indicators of Sustainability for Selected Human Communities in the Prince Albert Model Forest: Draft Report*. Canadian Forest Service. 78 pgs.

Scrimgeour, Garry. December 1998. *Forest Ecosystem Monitoring in Saskatchewan and Alberta: Identification of Aquatic Elements and Sampling Protocols: Part I: Annotated Bibliography*. Alberta Research Council. 59 pgs.

Scrimgeour, Garry. December 1998. *Forest Ecosystem Monitoring in Saskatchewan and Alberta: Identification of Aquatic Elements and Sampling Protocols: Part II: List and Evaluation of Potential Elements and Protocols to be Measured in Albert and Saskatchewan*. Alberta Research Council. 50 pgs.

Varghese, Jeji. July 1999. *Prince Albert Model Forest Public Participation Review*. Prince Albert Model Forest Association. 56 pgs.

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TABLE 3.10: LOCAL LEVEL INDICATORS OF PRINCE ALBERT MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Relative distribution of seral stages following natural (burned) and human (harvested) disturbances.	Hectares	PAMF	10 yrs	PANP, SERM and Weyerhaeuser	•High priority for PAMF. PANP data is old. •Reserve areas in need of inventory updates. •Technical committee established 01/00 to discuss seral stages divisions. •PAMF partners to contribute data by 12/00. Map will be produced early 2001.
Relative distribution and diversity of vegetative species following natural (burned) and human (harvested) disturbances	Estimated populations	Stand	5 yrs	PAMF	•Indicator added by partners. •Ties in with PESP's established in PAMF in 1999.
Relative abundance, species richness and diversity of migratory songbirds	Estimated populations	Stand	Annually	Weyerhaeuser EIS and PAMF	•Must be long-term commitment to monitor variability. •Need better site data; cannot rely on cover type alone. •Bird sampling should be done in PESP establishment sites to tie together both sets of data.
Area and percent of each forest stand type protected	Hectares	PAMF	10 yrs	SERM and PANP	•Protected categories will be those outlined by IUCN. •Stand types will be divided into seral stages. •Information to be provided by 12/00.
Percent of Prince Albert Model Forest area within 1 km of an active access road	—	PAMF	5 yrs	PAMF partners	•New indicator: PAMF will compile data from partners by 12/00.

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Forest fire number, areal extent, spatial distribution, frequency and shape	Hectares	PAMF	Annually	SERM, Weyerhaeuser and PANP	•Information supplied by PAMF partners by 12/00 and combined at PAMF early 2001.
Area, severity and duration of insect disease and damage	Hectares	PAMF	Annually	SERM and PANP	•SERM and PANP will report on this.
Blow down area extent, spatial distribution, frequency and shape	Hectares	PAMF	Annually	SERM and PANP	•SERM and PANP will report on this.
Percent of successful regeneration after harvest to pre-harvest growth track	Hectares	PAMF	Annually	Weyerhaeuser, CFS for Reserve Lands, and PANP	•Need results from free to grow surveys. Will have info 12/00. •This is long-term monitoring and 7 years may be too short.
Cut block size, shape and spatial distribution	Hectares	PAMF	Annually	Weyerhaeuser	•Information available 12/00. •Information will date back to 1986 and be sorted into 1year intervals.
Density of roads and landings in cut blocks	—	Weyerhaeuser FMLA	Annually	Weyerhaeuser	—

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent of watersheds recently (less than 10 years since disturbance) burned or harvested	—	PAMF	10 yrs	Weyerhaeuser and PANP	•A working group to determine watershed boundaries, stream order and scale. •Limiting factor is ortho photos. Data available for analysis 04 or 05/01.
Percent of harvested area and areas which have undergone post-harvest treatments having significant soil compaction, displacement (rutting and clumping), erosion and/or puddling	—	Weyerhaesuer FMLA	annually	Weyerhaeuser	•Ties in with Ken Van Rees work.

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Reduction of land base available for timber production	Hectares	PAMF	Annually	PAGC and SERM	•Information will be provided by 12/00. Will include permanent roads. •Resort villages have been removed from productive land base and will not be considered. •Provincial task force is also monitoring.

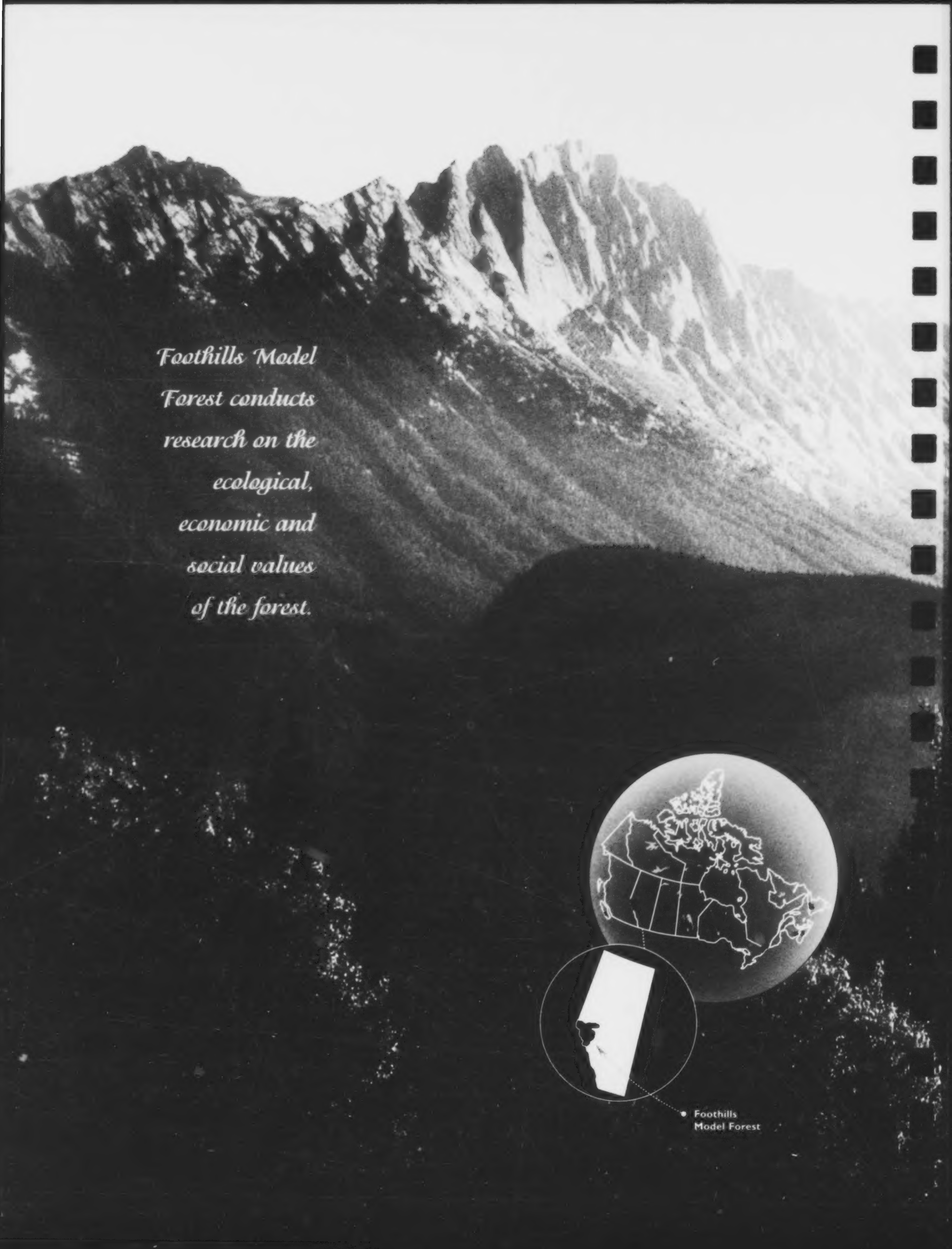
Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Number of people employed in the forest industry	Estimated populations	PAMF	Annually	PAGC and Statistics Canada	•Only includes residents of the PAMF, Waskesiu will be dealt with separately. •Data will be stratified into Aboriginal and non-Aboriginal.
Number of people employed in non-forest based activities	Estimated populations	PAMF	Annually	PAGC and Statistics Canada	•Only includes residents of the PAMF, Waskesiu will be dealt with separately. •Data will be stratified into Aboriginal and non-Aboriginal.
What is the potential work force	Estimated populations	PAMF	5 yrs	PAGC and Statistics Canada	•Only includes residents of the PAMF, Waskesiu will be dealt with separately. •Data will be stratified into Aboriginal and non-Aboriginal.

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Abbreviations

CFS:	Canadian Forest Service
PAMF:	Prince Albert Model Forest
EIS:	Environmental Impact Statement
PANP:	Prince Albert National Park
FMLA:	Forest Management Licence Agreement
PESP:	Permanent Ecological Sample Plot
IUCN:	International Union for the Conservation of Nature
SERM:	Saskatchewan Environment and Resource Management
PAGC:	Prince Albert Grand Council



Foothills Model Forest conducts research on the ecological, economic and social values of the forest.

Foothills Model Forest

FOOTHILLS MODEL FOREST

BACKGROUND

The Foothills Model Forest comprises 2.75 million hectares of boreal, montane and subalpine forest centred in the town of Hinton, a resource-based community of 10,000 people located 285 km west of Edmonton and 85 km east of the town of Jasper. It is the largest model forest in the Network and includes Jasper National Park, William A. Switzer Provincial Park, Willmore Wilderness Area, as well as the forest management area of Weldwood of Canada Ltd (Hinton Division).

The Foothills Model Forest consists of a diverse group of more than 40 partners who represent industry, academia, government, local communities and Aboriginal groups. Its principal sponsors are Alberta Environment, Jasper National Park, the Canadian Forest Service and Weldwood of Canada Ltd. (Hinton Division). Foothills Model Forest conducts research on the ecological, economic and social values of the forest.

The Foothills Model Forest has collected data on indigenous fish, plants and wildlife and has conducted research on alternative forest practices. In addition, a major study of natural disturbances, such as fire, will help guide long-term planning and operational activities, such as prescribed burns, harvesting and reforestation strategies, to better approximate natural disturbances and effectively maintain forest biodiversity.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

Before the Foothills Model Forest began to explicitly address LLI in 1997, their industrial partner (Weldwood) had already done a substantial amount of work in developing local level indicators for its license area as work towards eventual achievement of forest certification.

Initial purpose

It was felt to be important that indicators be used to demonstrate a linkage between key policy statements and the actual management plans of the three principal sponsors who have formal responsibilities and obligations for management of the area. In order for this to happen, the indicators would have to be explicitly linked to goals included in the management plans.

Getting started on the work program

A Local Level Indicators Steering Committee was established and comprised of two representatives each from the provincial government, Jasper National Park, and Weldwood with the Model Forest serving as secretariat. The Model Forest brought on a consultant in late 1997 to act as a knowledgeable and independent contributor. He participated in and organized several workshops (one on goals and the other on indicators) as well as a number of meetings with partners and the Board and helped write reports and chairs the technical committee. A workshop in late 1997 served to identify the shared goals of the three major land management partners. Management agencies specified which goals were "owned", "supported", "accepted" or "contested" by their agencies which allowed for stronger goal statements to be accepted than might otherwise have been the case. The Foothills Model Forest's local level initiative was initially led by its General Manager. Since 1999, the task of coordinating LLI activities lies with a staff projects coordinator.

LESSONS LEARNED — GETTING STARTED

- A small project steering committee should actively manage the process.
- The roles of the partners should be clearly defined at the outset.
- The process should be strictly aligned with the actual management planning initiatives of the partners.

SELECTING INDICATORS

Initial indicators

Foothills Model Forest accepted the six criteria established by the Canadian Council of Forest Ministers but did not use the CCFM indicators as a starting point. Instead, an initial set of indicators was generated locally, principally at a workshop held in March 1998, with the indicators intended to be used to measure the achievement of the shared goals that had been previously identified.

INDICATOR SCREENING CRITERIA

1. Clear relationship between indicator and biodiversity value
2. Ecologically meaningful
3. Useful
4. Easy to measure
5. Predictable
6. Data available
7. Understandable
8. Scientifically rigorous
9. Applicable at the appropriate scale and context

Refining the indicators

The process of refining the indicators was led by the consultant that had been brought on to help out with the process. Several screening criteria had already been identified in the Model Forest's five-year work plan from 1997. A report produced in September 1998 recommended a suite of 24 indicators which are yet to be formally approved by the Board of Directors.

Further testing and filling gaps

Some field assessment was done in the summer of 1999 through a bio-monitoring project, and is ongoing.

LESSONS LEARNED — SELECTING INDICATORS

- It is crucial to obtain agreement on the indicators to be used since without this agreement the initiative risks losing momentum. A shared set of indicators is also helpful in developing priorities for the Model Forest as a whole.
- The process must be recognized as adaptive and capable of continual improvement. Academic argument, uncertainty, the need for research, and some level of disagreement need not be justification for procrastination in actual monitoring.

GATHERING DATA

Initial assessment

It was recognized at the outset that there were going to be problems in collating the different data sets maintained by various management agencies. Federal lands tend to have less detailed vegetation inventories than provincial lands, and their ecological land classification systems are different. Work done prior to the beginning of the LLI initiative had looked at identifying common building blocks of the different inventories and this proved to be useful in developing a broad and general classification system which can be used to report on indicators. In addition, research is underway on using satellite imagery to map vegetation within Jasper National Park.

INDICATOR ELEMENTS

- Measurable attribute
- Objective related to the indicator
- Scale
- Measurement interval
- Sampling protocol
- Information needed to effectively monitor
- Population (variable or uniform)
- Degree of precision
- Degree of confidence
- Sampling design
- Availability, location and format of existing data
- Data collection requirements
- Data management and storage

Roles and responsibilities

Foothills Model Forest is currently seeking the assistance of its Activity Team Leaders in collecting extensive information on each indicator. A list of the points that need to be clarified for each indicator is included in a sidebar.

Current status

The Model Forest has polled its land managers, asking them to clarify which indicators they:

a) are currently reporting on;

b) intend and are able to report on;

c) agree should be reported on but are unable to do so (implying more research required); and

d) believe to be unnecessary or irrelevant (based on planning work conducted since the indicator workshops).

Once this survey has been completed, the results can be consolidated and provide the basis for a monitoring strategy.

Ongoing monitoring

Monitoring responsibilities will be determined as a result of the survey currently underway. The Model Forest's ongoing role in addressing gaps in the monitoring that is carried out by the management agencies has yet to be determined.

EXPERIENCE GAINED — GATHERING DATA

It has been a tremendous challenge to address the problem of inconsistent data across the Model Forest land base. In particular, the forest inventory that exists for Jasper National Park is of a very different nature than the timber inventory maintained by the province on the lands managed by Weldwood. This makes it difficult to report on many significant indicators across the entire Model Forest area.

USING AND REPORTING ON INDICATORS

Management Planning: The development and articulation of goals and objectives has been an intrinsic aspect of the LLI initiative from the very beginning.

Reporting: It has been agreed that the Model Forest will report on certain indicators while partners will report on other indicators. It is hoped that work from the Foothills Model Forest will be reflected in the province's annual State of the Environment Report which has a different theme each year.

Forest certification: Weldwood of Canada is pursuing certification of its Hinton division under the Canadian Standards Association's Sustainable Forest Management process and it is anticipated that the Model Forest will be able to assist with monitoring some of the indicators required under that process.

Broader application: The Foothills Model Forest has been asked to assist in developing and using suitable indicators for a new project called the Northern East Slopes Sustainable Resource and Environmental Management Strategy which involves four provincial government departments working together to develop a regional planning approach that will integrate economic, environmental and community values in the sustainable management of resources and the environment.

NEXT STEPS

The following tasks are priorities for the coming year:

- Finalize the set of indicators to be used by the Foothills Model Forest;
- Obtain commitment and support for its local level indicators initiative from the Board of Directors; and
- Make progress on data collection.

Publications and reports

- Dempster, W.R. September 1998. *Indicators of Sustainable Forest Management for the Foothills Model Forest.* Simons Reid Collins. 30 pgs.
- Schneider, R. August 1997. *Ecological Diversity Monitoring Framework: Draft for Discussion (#6).* 31 pgs.

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TABLE 3.11: LOCAL LEVEL INDICATORS OF FOOTHILLS MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Area of forest land by land use designation	# ha/ landuse	FtMF	5 yr	Prov inventory	—
Special features status	by feature	FtMF	5 yr	Prov inventory; Protective notations	—
Density of roads	km/ha	FtMF	1–5 yr	Weldwood Access management plan	•Interval to be discussed
Population levels/ indices of selected species or guilds	#/km^2	FtMF	5 yr	FtMF project status (fish, grizzly, harlequin duck, caribou); Weldwood and Provincial Studies and census	—
Habitat quality and quantity for selected species	# ha/species	FtMF	5 yr	Weldwood and JNP	—
Exploitation rates of biological resources	% species/yr, % decrease/ha	FtMF	1 yr	FtMF project status; Weldwood annual operating plan	—

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Tree insect and disease infestation	# ha	FtMF	5 yr	Prov inventory; CFS inventory	—
Fire occurrence, severity and cause	#fire/yr, #ha burn/yr	FtMF	1 yr	Weldwood; Prov	—
Threat minimization	—	—	—	—	•To be defined
Changes in landscape composition and pattern	# ha by landscape	FtMF	5 yr	Weldwood; Prov	—
Stand composition and structure	# ha by leading spp	FtMF	5 yr	Weldwood; Prov Inventory	—
Tree and stand growth rates	m^3/ha	FtMF	5 yr	Weldwood; Prov	—
Percent of attempted natural and artificial regeneration which was successful	# ha regenerated by type	FtMF	2 yr	Weldwood	—
Fish growth rates	—	—	—	—	•To be defined

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Physical soil properties	—	—	—	—	•To be defined
Soil nutrient status	—	—	—	—	•To be defined
Soil erosion and landform degradation	—	—	—	—	•To be defined

continued on the next page

Criterion 3
Conservation of Soil and Water Resources — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Water quality as measured by chemistry, turbidity, etc.	—	—	—	—	•To be defined
Water yield and regimen	—	—	—	—	•To be defined
Watercourse structure	—	—	—	—	•To be defined

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Criterion 5: Multiple Benefits to Society

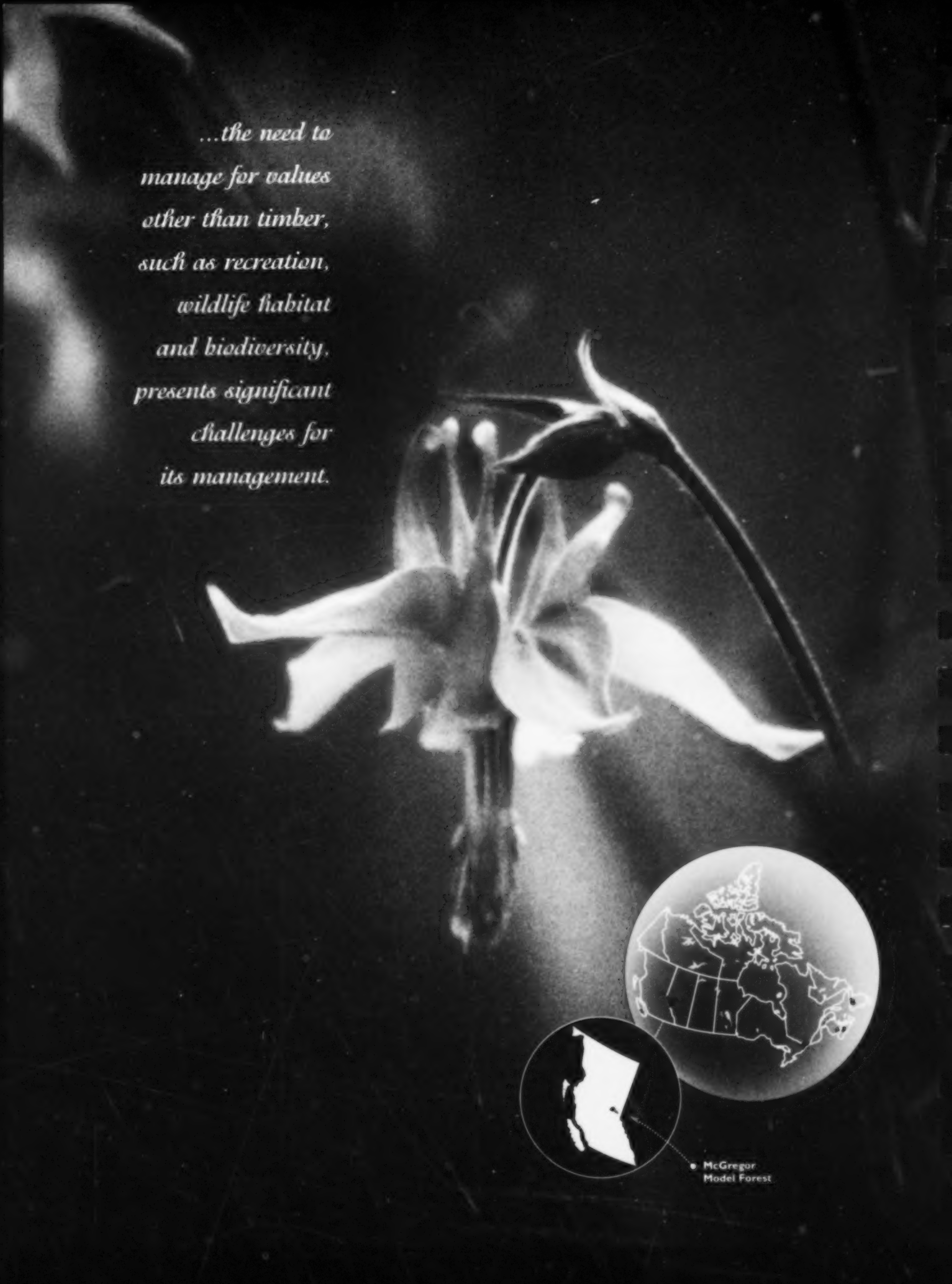
Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Competitive cost position	Health of industry	FtMF	As per Stats Canada	Stats Canada	•Define the measure
Employment in forest-related sectors	# employed by sector	FtMF	As per Stats Canada	Stats Canada	—
Incomes in forest-based communities by sector	Average household income	Alberta	As per Stats Canada	Stats Canada	—
Education	Level of education by sector	Alberta	As per Stats Canada	Stats Canada	—
Real estate values	Variance in value	Alberta	As per Stats Canada	Stats Canada	—
Social pathologies	Variance in incidence over time	Alberta	As per Stats Canada	Stats Canada	—

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Stakeholder involvement in forest decision-making	% participation in planning process	FtMF	As per plan renewal	Weldwood	—
Level of understanding and awareness of sustainable forest management.	# of people	FtMF	As per plan renewal or bi-annually	Census / polling by communications dept.	—
Continual improvement	% increase in awareness of people	FtMF	bi-annually	Census / polling by communications dept.	—

ABBREVIATIONS
CFS: Canadian Forest Service
FtMF: Foothills Model Forest
JNP: Jasper National Park

...the need to
manage for values
other than timber,
such as recreation,
wildlife habitat
and biodiversity,
presents significant
challenges for
its management.


McGregor Model Forest

McGREGOR MODEL FOREST

BACKGROUND

The McGregor Model Forest is located approximately 30km northeast of Prince George, British Columbia and encompasses 181,000 ha of montane and subalpine forest approaching the western slopes of the Rocky Mountains.

The area is an important provider of timber and jobs for local communities but the need to manage for values other than timber, such as recreation, wildlife habitat and biodiversity, presents significant challenges for its management.

Since 1993, McGregor's 33 partners have been working on projects related to research to enhance understanding of ecological relations and their variability across the landscape, the impact of past forest practices on the landscape as it exists today, and the social and economic relations of the forest to local communities. This work has allowed for the development and application of advanced modelling techniques, forecasting and visualization tools in support of scenario planning. Scenario planning provides for the expression of public values and *their translation into operational approaches for* management in a future of uncertainty.

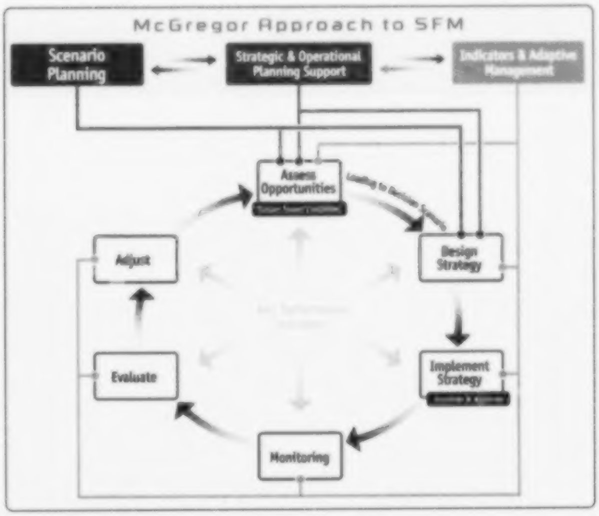


FIGURE 3.1 —
McGregor Model Forest Approach to Sustainable Forest Management

Canfor, the licensee that holds the tenure for TFL30 (Tree Farm License 30; the McGregor Model Forest), is using the results of scenario planning in its next official forest management plan for the area.

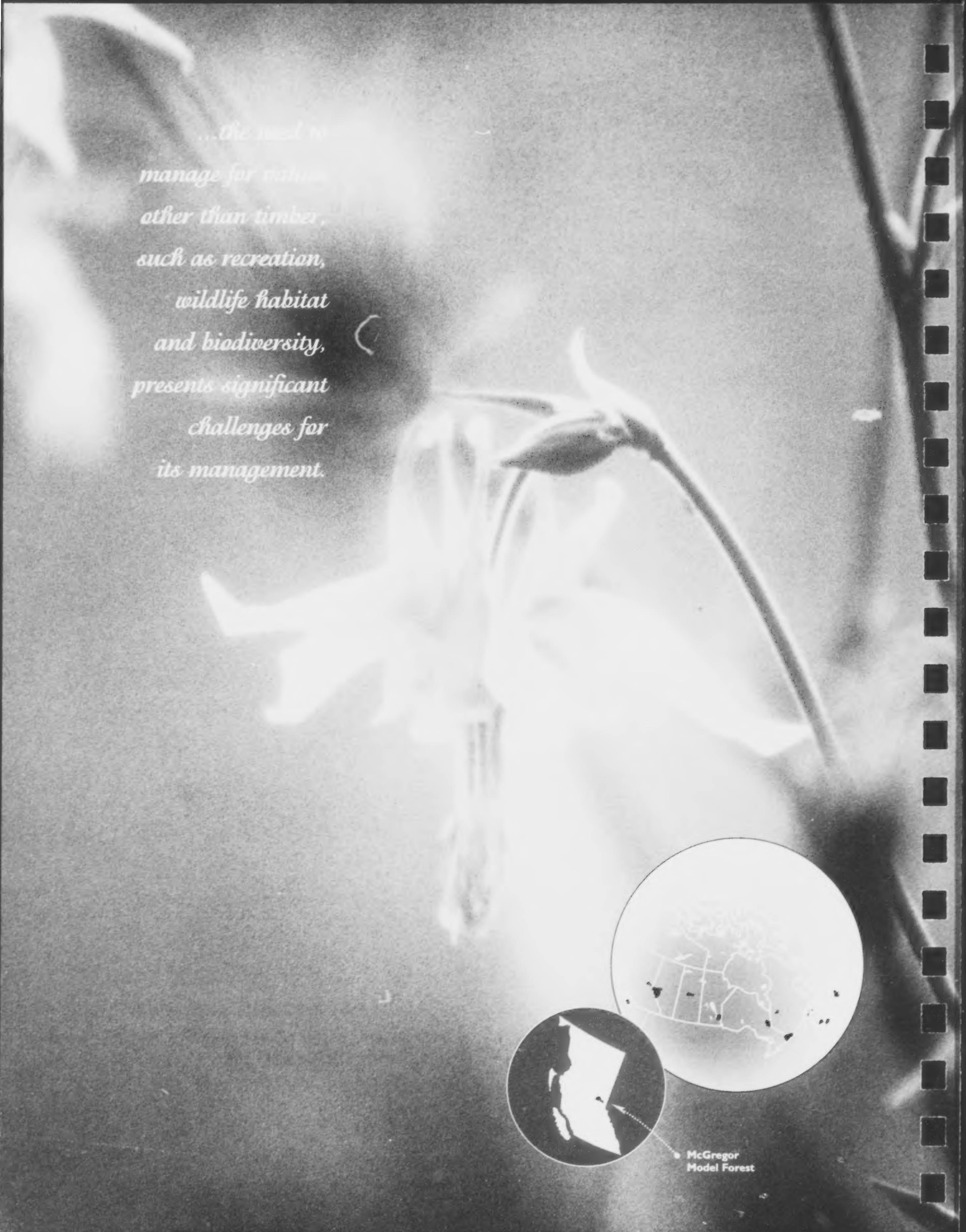
INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

A considerable amount of work related to local level indicators was carried out during the first phase of the Model Forest (1992–1997), and even though much of that work pre-dated the completion of the Canadian Council of Forest Minister's development of national C&I, it has been possible to translate McGregor's prior work into the CCFM framework. In 1997, the McGregor Model Forest hosted a workshop of its research participants in an attempt to derive practical indicators of sustainable forest management based on the results of the research undertaken in ecological processes, forest practices, and social and economic trends and analyses. The indicators proposed were subsequently evaluated and categorized according the Canadian Approach to sustainable forest management.

Initial purpose

From the beginning, the McGregor Model Forest decided that its work on local level indicators would be an integral component of the McGregor Approach to SFM, which is described in the accompanying figure. The indicators selected during scenario planning are forecasted over time and are subsequently expressed in several ways to aid in


McGregor
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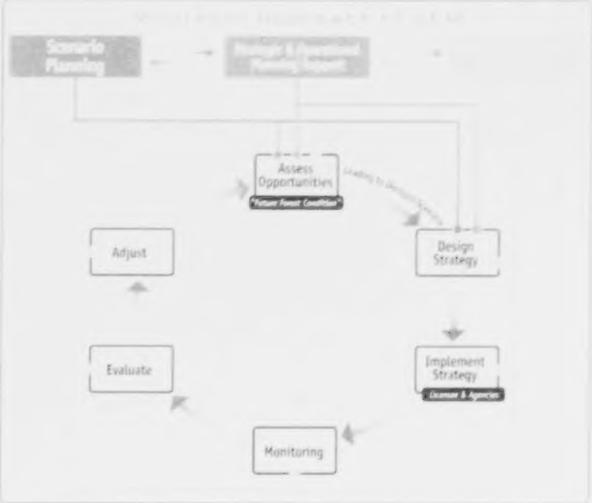

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Initial purpose

From the beginning, the McGregor Model Forest decided that its work on local level indicators would be an integral component of the McGregor Approach to SFM, which is described in the accompanying figure. The indicators selected during scenario planning are forecasted over time and are subsequently expressed in several ways to aid in the analysis of resource objectives. The use of visualizations allow for the quick interpretation of change on the landscape over time which facilitates public appreciation of the management process and projected outcomes. This technique is particularly helpful in selecting the final or decision scenario that will be managed for.

EXPERIENCE GAINED — AN EFFECTIVE WORK PLAN

The main goal of the McGregor Model Forest in shifting into the "case study mode" was to increase its capacity in operational settings. Clearly, experience was gained, particularly in the identification of operational objectives within the realities of the industry and the values of the public. To think that what is designed in a laboratory using sophisticated models can be simply applied on the ground is foolhardy. Ideas and approaches need to be field tested, evaluated, adapted and tested again. The biggest mistake that anyone can make is to believe that a final solution is a final solution.

In many respects, the achievements of the Model Forest were dependent upon the progress of others. Indeed, this is what community decision making is all about — working together.

It is important to work toward achieving confidence of the public in what we do. As foresters and resource managers we have a lot of work to so in this area.

Getting started on the work program

The McGregor Model Forest draws on the support from its Program Advisory Committee which is made up of members from the partnership. Initially, program working groups were established to provide direct guidance in the development and implementation of project work, with separate groups on Local Level Indicators and Adaptive Management, Strategic and Operational Planning Support, and Communications. However, with an evolution in program focus, there were significant changes to the program groups. While the Program Advisory Committee remained intact, the new format of delivery was to actively engage in operational case studies, and the McGregor Model Forest now placed a portion of its reliance to achieve program goals and objectives on a broader spectrum of participants that were actually involved in resource management.

For each case study a work plan was prepared that outlined the contribution of the McGregor Model Forest and this was integrated into the overall implementation plan for the case study. In participating in case studies, the McGregor exercised its skills in scenario planning, development of objectives, identification of indicators and analysis. The delivery of McGregor's responsibilities relied heavily on those involved with GIS, resource analysis and communications.

McGREGOR MODEL FOR
TECHNOLOGY

SELECTING INDICATORS

Initial indicators

A workshop in February 1997 brought a range of researchers together to report on the projects they were involved in and to nominate relevant indicators. This list of nominated indicators formed the preliminary list that the McGregor Model Forest worked with. These indicators were supplemented by a project focussing on social valuation research, with a final report recommending key social indicators, their measurement and how they might best be integrated into McGregor's management planning framework (Robinson and Hawley 1997). Results of both processes were combined in a report identifying an initial set of 87 potential local level indicators.

INDICATOR SCREENING CRITERIA

1. Easily understood
2. Cost effective and timely
3. Measurable
4. Reliable
5. Sensitive
6. Independent
7. Scope (broadly applicable)
8. Contribute to forest policy
9. Scale is clearly defined

Refining the indicators

To oversee the project, the McGregor Model Forest assembled a team of land managers comprising representatives from Northwood (Canfor), the Ministry of Forests, the Ministry of Environment, and the Department of Fisheries and Oceans. This team selected 17 indicators to work with in developing a set of scenarios in its initial case study. The criteria used to select indicators are included in the sidebar and defined in greater detail in a background report (McClain, September 1998).

Further testing and filling gaps

The real test of these indicators came when the McGregor Model Forest conducted a case study on the Model Forest land base. A number of different learning scenarios were developed based on different management priorities such as: a) the base case (business as usual); b) biodiversity; c) wildlife; d) fish habitat; and e) "biodiversity plus". Based on some objectives, trends, and values, indicators were forecasted over time and analyses conducted. All forecasts were represented in a spatial manner allowing for the changing qualities of the forest to be visualized.

In preparing its first set of case studies roughly one third of the indicators needed to be replaced and many modifications were made to the other indicators. At the end, 16 indicators remained.

EXPERIENCE GAINED —
LINKING INDICATORS WITH OBJECTIVES

Unless objectives are defined using SMART principles (Succinct, Measurable, Achievable, Relevant, Timely) it is nearly impossible to develop practical indicators and forecast them over time. In a similar vein, unless the full range of stakeholders are available to participate in the scenario planning process, it becomes difficult, if not impossible to complete the process with confidence. Full participation allows for understanding and appreciation of other resource values and their basic requirements.

GATHERING DATA

Initial assessment

In general, the McGregor Model Forest's approach has been on forecasting future values for its indicators rather than on recording and monitoring the current state of the forest. The forecasting of indicators into the future has been based on detailed inventory information supplemented by historical information and expert knowledge. In some instances indicators can be utilized by simply identifying a threshold that must not be exceeded. With experience and the collection of information on indicators refinements can be made with respect both to how indicators are interpreted as well as the processes used.

Roles and responsibilities

The work of integrating data on the indicators into refined or revised scenarios will be assisted through McGregor's GIS unit, currently comprising two staff and a co-op student.

Current status

A "first approximation" for developing a monitoring framework was developed for the McGregor Model Forest (McClain, November 1998) and the partners are currently developing monitoring plans and programs.

Ongoing monitoring

The management agencies are expected to carry out monitoring of the indicators relevant to their areas of activity on an ongoing basis. Those that have responsibility for management under BC legislation are in the best position to maintain the responsibility for monitoring. This would also require them to be responsible for storing the data.

EXPERIENCE GAINED — GATHERING DATA

It is crucial to have a well developed data base management system; one that will support monitoring and analysis. It is a good idea to seek experienced advice and assistance in setting up databases.

USING AND REPORTING ON INDICATORS

Scenario Planning: As described above, this is the main way in which the McGregor Model Forest is using local level indicators. Local level indicators are an integral component to the McGregor Model Forest's approach to sustainable forest management. Indicators are an integral, inseparable part of that approach.

Management Planning: Canfor has indicated that it will incorporate the scenario planning approach in the preparation of its next forest management plan for the district, due in 2001.

Forest certification: The McGregor Model Forest anticipates playing a role in facilitating Canfor's pursuit of certification under the Canadian Standards Association and the Forest Certification Council.

Knowledge Transfer: The McGregor Model Forest has taken a keen interest in encouraging the broader application of its scenario planning model. Scenario planning remains to be one of several key components of the McGregor Model Forest Approach to Sustainable Forest Management (Figure 3.1). Additional case studies are being conducted developing increased depth in social and economic indicators and greater refinement in modelling interactions and interpreting the results. There is growing interest in the McGregor Approach to SFM. It is not so much the indicators themselves that are important, but rather it is the approach that allows for the development of resource objectives that are consistent with our understanding of what SFM is. Indicators are only parameters that we measure over time. Determining what is meant by their changing value is important in interpreting our success in maintaining a sustainable environment.

Communications: In addition to working actively with resource managers to apply McGregor's scenario planning model, the McGregor Model Forest has given a large number of presentations aimed primarily at land managers and stakeholder groups.

Reporting: The McGregor Model Forest reports its results as frequently as possible, especially to the agencies involved in the approach.

NEXT STEPS

A second case study is now underway covering an area greater than 3 million hectares managed by six forest products companies, five communities and a number of First Nations. A wider range of stakeholders are involved in setting the parameters for the various different scenarios with the project scheduled to be completed in January 2001.

Publications and reports

- McClain, Dr. Keith. August 1998. *Program Team Summaries and Identification of Potential Local Level Indicators for the McGregor Model Forest*. McGregor Model Forest Association. 68 pgs.
- McClain, Dr. Keith. September 1998. *Local Level Indicators and Monitoring: A Backgrounder*. McGregor Model Forest Association. 27 pgs.
- McClain, Dr. Keith. November 1998. *A Framework for Monitoring Indicators of Sustainable Forest Management (First Approximation)*. McGregor Model Forest Association. 17 pgs.
- McClain, Dr. Keith. April 1999. *The Development of Sustainable Forest Management Indicators on the McGregor Model Forest: Progress Report*. McGregor Model Forest Association. 14 pgs.
- Robinson, Dr. Dave W. and Dr. Alex W.L. Hawley. December 1997. *Social Indicators and Management Implications Derived from the Canadian Forest Survey '96*. McGregor Model Forest Association. 49 pgs.

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TABLE 3.12: LOCAL LEVEL INDICATORS OF McGREGOR MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data
Percent and extent of area by forest type and age class	Percent distribution of DFA	Planning unit (or could be landscape or it could be the areas detailed by the timber supply area)	As required that would provide the necessary information; probably 5 yr intervals)	High-level photography, Land-sat, remote sensing
Patch-size distribution by natural disturbance type by landscape unit by age class	Area (hectares); but the value may be expressed as a ratio to area of DFA and landscape area	Landscape unit	Every 5 yrs	Inventory and high elevation photography (for spatial reference)
Percentage productive area > 100 years in Forest Ecological Networks	Percent of area fulfilling specific requirement (i.e. >1000 yrs old)	Landscape or the DMF	This would be linked into forest inventory and records of harvesting (forest accounts)	Inventory (on the ground, photo)
Percentage productive area < 3 m height in Forest Ecological Networks	Area (area/area x 100)	Landscape, DFA	Annual	Surveys
Percentage productive area < 80 years by Caribou Zone	Percentage (area/area x 100)	Productive zones within Caribou Zone	Once a base line has been established inventory and an account system would provide the necessary information	Inventory
Area harvested in grizzly habitat zones	Area (this could be expressed as a ratio of area harvested / total grizzly bear habitat)	Landscape with the DFA	Annual	Inventory, operating plans

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data
Area of extreme and high spruce bark beetle hazard stands by period	Area (ha). This could also be expressed as a percentage	Landscape within the DFA	Typically, 20 years, but could be shorter depending on local factors	Aerial surveys and inventories

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data
% ECA by period for each watershed	% (area in ECA condition / total area in water shed x 100)	Watershed	Annual	Inventory / survey (in relation to free growing assessment)

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

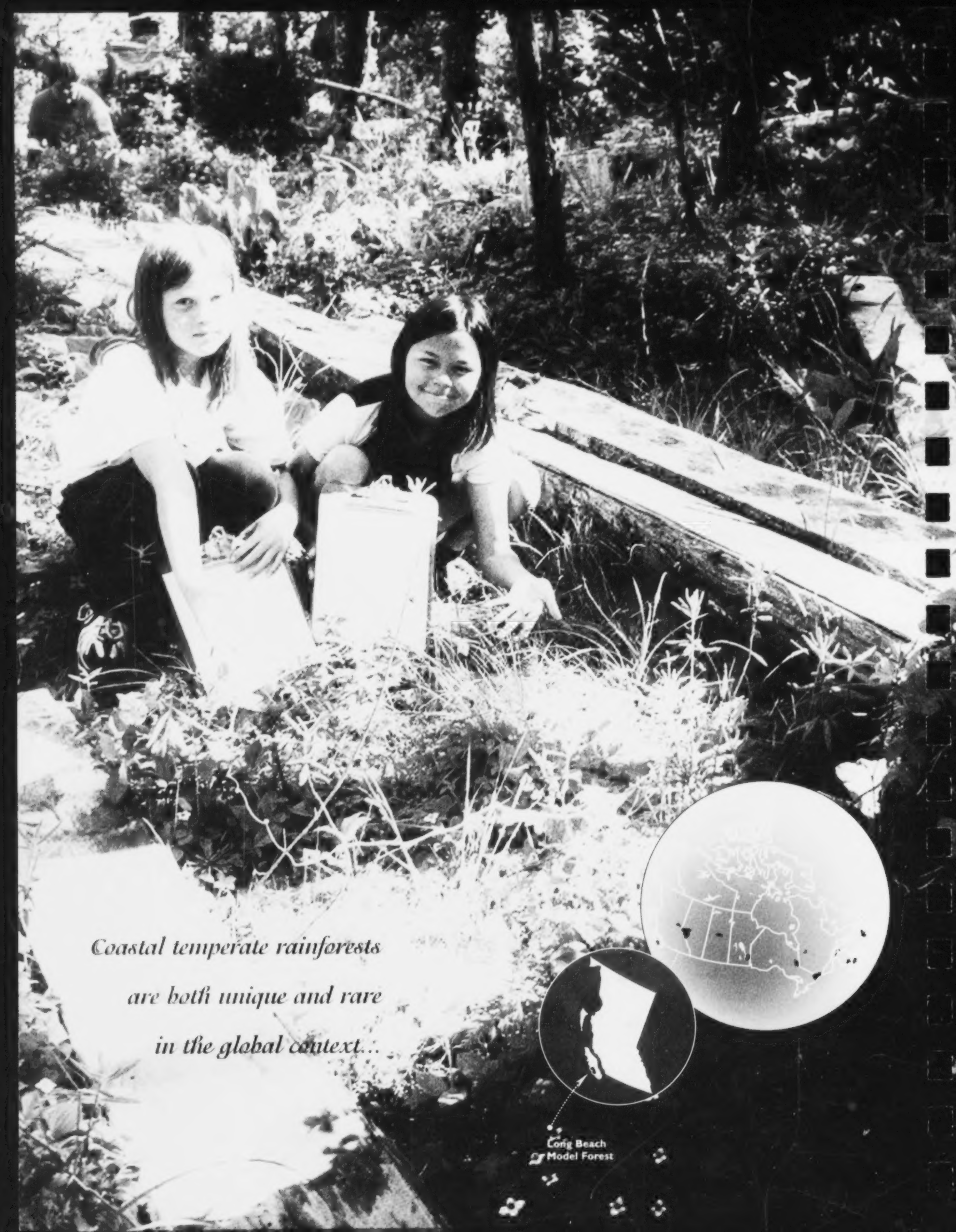
Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data
Quantity of forest products harvested by species and product	m^3 by species and raw product (etc saw log, pulp)	Within DFA by site and forest type	Annual Scaling and production records	—
Total growing stock	m^3 (this would be partitioned by species and site type)	DFA / province	Annual	Inventory as adjusted by inputs (regen) and outputs (harvests)
Crown forest area available for timber production	ha	DFA / province	Annual	Inventory
Average annual area harvested	ha	DFA / province	Annual	Inventory / operating plan
Area harvested in backcountry recreation zones	ha	DFA	Annual	Inventory / operating plan
Area harvested in Front country recreation zones	ha	DFA	Annual	Inventory / operating plan
% Denuded by VQO polygon by period	% (area denuded / total area of polygon)	Landscape (which can contain multiple polygons)	10–20 yr (the period is defined by objective)	Survey

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Abbreviations

DFA: Defined forest area
ECA: Equivalent clearcut area
VQO: Visual Quality Objectives


Long Beach Model Forest

Coastal temperate rainforests
are both unique and rare
in the global context...

Coastal temperate rainforests are both unique and rare in the global context...

Long Beach Model Forest

LONG BEACH MODEL FOREST

BACKGROUND

The Long Beach Model Forest is made up of 400,000 hectares of coastal temperate rainforest in the Alberni-Clayoquot Regional District on Vancouver Island. It extends from Escalante Point at the northwest end of Clayoquot Sound to Effingham Inlet in Barkley Sound in the southeast. Recognition of the need for sustainable forest practises in the area followed the controversy that erupted in 1993 over clearcutting in Clayoquot Sound.

Coastal temperate rainforests are both unique and rare in the global context, combining terrestrial, fresh water, estuarine and marine ecosystems. The coastal rainforest region of Canada is notable in terms of its rugged terrain, the broad range of ecosystem types resulting from high variability in landform, temperature and rainfall, as well as dramatically high levels of biodiversity.

More than 5,000 people live in the area which includes communities within the territories of the Tla-o-qui-aht, Hesquiaht, Ahousaht, Toquaht and Ucluelet First Nations as well as the Districts of Tofino and Ucluelet.

About 45 partners, including local communities, environmental groups, the logging companies active in the area and Pacific Rim National Park Reserve, take part in numerous programs. Research has covered a diverse range of subjects, including aquatic resources, the impact on the ecosystem of land uses and practises, and numerous projects with First Nations partners such as the mapping of resources and cultural sites in the forest and an examination of culturally important plants and how logging affects them.

INITIATING A PROGRAM ON LOCAL LEVEL INDICATORS

Prior activities

There are a number of current and ongoing initiatives in the area that relate to, but predate, the Model Forest's work on local level indicators. Most noteworthy of these was the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (Clayoquot Sound Scientific Panel) and their recommendation for a monitoring program that would ensure that objectives are being achieved.

Initial purpose

An early decision was made to involve the local community in developing the most appropriate indicators.

Getting started on the work program

The Long Beach Model Forest formed a Criteria and Indicators Working Group including participation from Model Forest staff, partner organizations, Board members and members of the public. The Model Forest's Research Coordinator provided considerable input into the work of this committee.

The Criteria and Indicators Working Group met in June 1998 to develop a work plan. Staff from the Long Beach Model Forest and the Clayoquot Biosphere Project wrote the proposal for the project, "Work Plan For The Monitoring Program of The Scientific Panel For Sustainable Ecosystem Management in Clayoquot Sound", which was carried out by a contracted consultant. The identification of local level indicators and a monitoring strategy involved public participation through a two day workshop followed by input from various technical experts. Members of the Criteria and Indicators Working Group facilitated the workshop. The Working Group met in March 1999 to prepare work plans. In March 2000 the Working Group met again to assess progress to date and prepare and update work plans for the April 2000 to March 2001 time period. The Criteria and Indicators Working Group continues to guide the development of the Long Beach Model Forest local level indicator and monitoring programs.

On November 29, 1999 the Ucluelet and Area Vision Society held a "Building a Shared Vision For the Ucluelet and Area Community" symposium. This symposium was the third in a series of workshops spanning over three years with the goal of developing a holistic and sustainable management model for the Ucluelet area.

SELECTING INDICATORS

Initial indicators

A large set of indicators was derived by compiling suggested indicators from a wide variety of sources: the Canadian Council of Forest Ministers, the Centre for International Forest Research (CIFOR), the Clayoquot Sound Scientific Panel, Pacific Rim National Park Reserve, and other Model Forests. This work was completed in approximately one month by a consultant under contract to the Long Beach Model Forest. She carried out an initial filtering process eliminating indicators inappropriate to the context or scale of Long Beach and brought the remaining set to the workshop described below.

INDICATOR SCREENING CRITERIA

1/ Basic Description

- definition and purpose
- unit of measure
- applicability to various agencies
- scale
- standards or target levels
- relationship to forest practises

2/ Evaluation of Usefulness

- precisely defined
- easy to detect, record and interpret
- sensitive to change

3/ Measuring and Monitoring

- current status of data
- measurement methods or protocols
- measurement frequency
- monitoring responsibilities
- data management and storage
- cost

Refining the indicators

A two-day workshop was held in November 1998 with about 40 people attending. Participants were invited from federal, provincial and local governments, academia, environmental organizations, and First Nations. They broke into working groups according to their experience and expertise: watershed and coastal integrity; biological diversity; and human activities and values. These groups then described, evaluated and scored potential indicators in a great deal of detail as summarized in the sidebar.

This detailed analysis allowed the Long Beach Model Forest to address the issues of data gathering and monitoring at the same time as it pared down its initial list of indicators to a more manageable set.

EXPERIENCE GAINED — INCORPORATING FIRST NATION AND SOCIAL VALUES

First Nations participation was not sufficient to provide the workshop participants with the confidence to develop and finalize indicators reflecting First Nations values. This step has proven to be a challenge for Long Beach Model Forest. The problem was solved by incorporating the development of local level indicators specific to local First Nations into a larger research project being initiated and implemented by First Nations in association with the Model Forest. Long Beach is working on "The Meaning and Practice of Hahuulhi — the Traditional System of Ownership and Resource Management for the Nuu-chah-nulth People And Its Application For Sustainable Forest Management".

Social (human activities and values) indicators were also difficult to refine in the November 1998 workshop. Long Beach used a 'screening' approach to the identification of criteria and indicators. This involved accumulating data from various sources and filtering them for applicability to the local context. For the social criteria and indicators, this approach was not as successful as for the indicators dealing with watershed and coastal integrity or biological diversity attributes. The work of the Ucluelet and Area Visioning Society in November 2000 used a 'clean slate' approach and successfully filled several gaps in the set of social indicators.

Further testing and filling gaps

As a result of the November 1998 workshop and subsequent technical review it was felt to be necessary to do additional work on developing indicators that better reflected First Nations perspectives as well as effective socio-economic indicators. Several projects were started in order to address these gaps.

GATHERING DATA

Initial assessment

The November 1998 workshop included a preliminary discussion of existing data for each indicator, as well as data monitoring needs. Using information coming out of that workshop, a consultant prepared a detailed work plan to put in place a systematic monitoring program. The organization and structure of this work plan was formed by the consultant's prior experience with CIFOR's North American test of criteria and indicators of sustainable forestry and included the following information for each indicator:

a) an overview description of the indicator's relevance;
b) scale;
c) monitoring details such as appropriate units of measure;
d) types of costs to be incurred (data, labour, logistics);
e) frequency of data collection;
f) verifiers (such as existing standards or target levels for the indicator);
g) overlap with other indicators;
h) key contacts; and
I) references.

Roles and responsibilities

Long Beach Model Forest has launched a monitoring pilot program for some of the biophysical indicators that have been identified. This will provide some valuable operational experience regarding data gathering methodologies. The pilot project will also allow the model forest and its partners to establish protocols around data gathering, compilation, and presentation.

The Clayoquot Sound area has a number of organisations with mandates to monitor forest resource management sustainability. As a result, extensive consultation and coordination is required. This consultation has begun in 2000. By the end of the year, the Model Forest will have a refined set of local level indicators including appropriate First Nations and social indicators and will have gained important operational experience in monitoring some of the biophysical indicators. The Model Forest will also have coordinated an integrated approach to monitoring with other important groups and organisations. Data and reporting matters will be resolved.

Current status

The Long Beach Model Forest Board of Directors has accepted the local level indicators and monitoring framework as proposed by the consultant. However, monitoring is presently a work in progress. Data collection, compilation and presentation issues have not been resolved.

Ongoing monitoring

A number of agencies in the region, including the Long Beach Model Forest, the Clayoquot Sound Planning Committee and the Clayoquot Biosphere Project, will share responsibilities for monitoring on an ongoing basis.

EXPERIENCE GAINED — SELECTING INDICATORS

The Long Beach Model Forest is developing a suite of indicators in several incremental steps. The process has been open to public participation. The working group implementing the program and the initial workshop in November 1998 were attended primarily by experts or individuals with significant capacities in resource management. Later events have attracted more of the area's general public. At each step the extent and quality of public participation has improved. While the process has been time consuming and somewhat inefficient, the Model Forest is confident that the suite of indicators identified and the monitoring program which is emerging will reflect broad community support.

USING AND REPORTING ON INDICATORS

Reporting: The Long Beach Model Forest has not yet reported on its indicators. It is anticipated that the indicators will be used and reported in a variety of ways. Indicators will assess whether the forest practices recommended by the Scientific Panel achieve their intended objectives. Indicators will ensure that forest activities and practices comply with prescribed standards for local certification efforts. Finally, indicators will improve the basis for understanding mechanisms that cause events and create changes in our ecosystems. Computer software models are currently being explored as indicator assessment and communication tools.

NEXT STEPS

Long Beach Model Forest has a number of important initiatives planned for the coming year that relate to the development and use of local level indicators:

- Climate and hydrometric monitoring in Clayoquot Sound in partnership with the BC Ministry of Environment and Forest Renewal BC.
- Nuu-chah-nulth naturalized knowledge and social local level indicators. This project involves direct consultation with First Nations, a workshop with First Nations, and a workshop with First Nations and non-First Nation communities.
- Endorsement of a suite of indicators through wide community participation in a workshop.
- Coordinating monitoring efforts and sharing operational experience with other regional organisations with a monitoring mandate.
- Implementation of a data management strategy.
- Monitoring program assessment tools.
- Adaptive monitoring pilot project.

It is expected that the Long Beach Model Forest Board of Directors and other partner organisations will once again endorse the suite of local level indicators and a monitoring plan.

Publications and reports

Beasley, B. 1998. *Criteria and Indicators Workshop Proceedings — Long Beach Golf Course, November 12–13, 1998.* Long Beach Model Forest. 58 pgs.

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Loucks, Laura. December 1999. *Building a Shared Vision For the Ucluelet and Area Community — Symposium Report.* Written for the Ucluelet and Area Community Vision Society, December 1999. 29 pgs.

Smith, Joanna. 2000. *Ecological Monitoring at the Long Beach Model Forest — Implementation of the Monitoring Workplan of the Scientific Panel for Sustainable Ecosystem Management in Clayoquot Sound.* Long Beach Model Forest. 34 pgs.

Wright, Pamela. December 1998. *Work Plan to Operationalize the Monitoring Program of Program of the Scientific Panel for Sustainable Ecosystem Management in Clayoquot Sound.* Submitted to the Clayoquot Sound Planning Committee for the Long Beach Model Forest Society and the Clayoquot Biosphere Project. 100 pgs.

Further information

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TABLE 3.13: LOCAL LEVEL INDICATORS OF THE LONG BEACH MODEL FOREST

Criterion 1: Conservation of Biological Diversity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Percent and extent of area by forest type and age class.	Distribution of area and extent of forest types (as a surrogate for structure class).	Watershed with interpretation to the regional level.	Preharvest then post harvesting at 5 year intervals.	Inventory data such as terrestrial ecosystem mapping.	No plans at present to initiate measurements. Inventories are available.
Level of forest fragmentation and connectedness of forest ecosystem components.	Exact specifications for connectivity and fragmentation are not well known. Patch shape, patch size and extent, patch connectivity, patch dispersion, nearest neighbour probability and percolation index.	Clayoquot Sound (forest management unit). Stand level of developed vs. undeveloped watersheds.	Pre-development then every 2-3 years.	Digital inventory data.	Interpreting fragmentation/ connectivity data is difficult. Technical interpretation may require research. No plans at present to initiate measurements.
Change in roadedness per volume of trees removed associated with modified forest practices.	Overall roadedness and changes in roadedness associated with modified practices. Length of road per unit area.	Watershed	Irregularly to accompany changes in land use activity. Every 5 years.	GIS based maps.	No plans at present to initiate measurements. Road density threshold information is not as available for the affects of roads on physical factors such as microclimate, wind and changes in hydrologic flows or for invertebrates and other smaller species.

continued on the next page

Criterion 1
Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Population size and reproductive success of species at risk.	Monitor species to determine whether they face changes in population size or distribution (species abundance and reproductive success). Concentrate on species of concern including exotic species, vagrant species or 'select' indicator species. Concentrate on species at risk including threatened, endangered or vulnerable species. Population size and reproductive success are also key factors in maintaining genetic diversity.	Watershed comparisons.	2–5 years	Permanent monitoring plots. Trend data and comparisons across watersheds. Population viability models. Natural levels of variability and population size affect the calculation of an adequate population size.	Inadequate knowledge of the full complement of species within Clayoquot Sound and the lack of habitat specific information on many known species, complementary research is required. Requires species-specific methodologies. Some species specific data already exists. Most research recommends selecting species that are: 1. At risk in the management area 2. Of particular economic or social value 3. Considered to be umbrella species. No plans at present to take measurements.

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Criterion 1
Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Changes in genetic diversity of species undergoing selective pressures.	Measure genetic diversity for species particularly susceptible to genetic selection concerns. This measure is to be used only for species of substantial concern such as trees and salmon.	TREES Permanent monitoring plots with interpretation at the watershed level. SALMON Stream based sampling across watersheds.	TREES Preharvest then every 10 years. SALMON Every 10 years.	TREES Select target species and populations sensitive to forest practices. List forest interventions and predicted impact on gene frequencies. Identify species likely to be impacted. Assess whether there are adequate reserves. Compare sample plot to monitor for phenotypic traits expected to show directional gene frequency change. Progeny tests of seeds from seed trees and control areas. SALMON Tissue sampling subjected to genetic analysis. Monitor fish wheels for visual polymorphism.	Research projects may be required to establish methodologies.

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Criterion 1
Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Population size/reproductive success of species dependent on interior forest conditions.	Assessing the status of forest dwelling species that depend on forest interior conditions is one way of measuring the effects of detrimental effects to habitat. Is an 'impact' indicator. Monitoring can contribute to evaluating the success of the proposed forest management system but also to determine potential thresholds of habitat change and early warnings of population declines.	Site level at permanent monitoring plots. Developed vs. undeveloped watersheds.	Seasonally to get range of species diversity in various life stages/habitat use.	Trend data to provide early warning with additional research where problems are noted. Require data on forest treatments, fragmentation and connectedness.	Specific monitoring protocols for species at risk are required.
Size and distribution of contiguous patches.	This specific indicator may be a variable for another indicator.	—	—	—	—
Amount and distribution of edge.	This specific indicator may be a variable for another indicator.	—	—	—	—
Changes in patch size distribution in relation to natural patterns of disturbance	This specific indicator may be a variable for another indicator.	—	—	—	—

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Criterion 1
Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Changes in amount and complexity of vertical habitat structure.	Direct assessment of structural class, particularly vertical habitat complexity. Measurement of the height of each layer will assess structural changes following disturbance.	Stand level within developed and undeveloped watersheds.	Pre/post harvesting, every 2 years post harvest until 10 years and then every 10 years.	Permanent monitoring plots.	Permanent monitoring plot pilot project implemented in 2000. Additional research studies and monitoring around wildlife/ danger trees.
Abundance of coarse woody debris, snags, etc.	Standing dead tree, live cavity tree per unit area. Downed coarse woody debris by size class as mass per unit area. Functional utility to maintain species.	Stand level.	Pre/post harvest then at 5 year intervals.	Permanent monitoring plots.	Permanent monitoring plot pilot project implemented in 2000. Additional research studies and monitoring around wildlife/ danger trees and coarse woody debris.
Number of known forest-dependent species classified as extinct, extirpated, endangered, threatened or vulnerable relative to total number of known forest-dependent species.	This specific indicator may be a variable for another indicator.	—	—	—	—
All naturally occurring species are maintained within sub-regions.	Species presence using a checklist approach for vascular plants, mosses, macrofungi, liverworts, lichen, mammals, birds, amphibians and molluscs.	Site level with interpretation across watersheds.	2–5 years	Permanent monitoring plots with additional plots or transects.	Permanent monitoring plot pilot project initiated in 2000. However, this indicator will not be measured. No specific plans at this time.

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Criterion 1

Conservation of Biological Diversity — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Absence of species or visible subspecies from formerly populated areas.	This specific indicator may be a variable for another indicator.	—	—	—	—
Degree of range reduction of sensitive species.	This specific indicator may be a variable for another indicator.	—	—	—	—
Population size and reproductive success are adequate to maintain levels of genetic diversity.	This specific indicator may be a variable for another indicator.	—	—	—	—
No significant changes in gene frequencies in trees.	This specific indicator may be a variable for another indicator.	—	—	—	—

Criterion 2: Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Presence/relative abundance of exotic, vagrant and expanded range species.	Specific species abundance and distribution considered.	To be developed.	To be developed.	To be developed.	LBMF is considering indicators specific to First Nations traditional medicinal plants.

Criterion 3: Conservation of Soil and Water Resources

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Foliar nutrients.	Standard foliar nutrients.	Site level, compare developed with undeveloped watersheds.	10 years	Permanent monitoring plots	LBMF is establishing permanent monitoring plots in a pilot project in 2000.
Soil properties.	Indicator not considered.	—	—	—	—
Rates of decomposition.	Rates of decomposition.	Site level	5 years	Permanent monitoring plots.	LBMF is establishing permanent monitoring plots in a pilot project in 2000. Methodology requires development.
Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss or organic matter, etc.	% mineral soil exposure, soil compaction, loss of organic matter.	Site level	Pre then post harvest measurement every 2 years for 10 years.	Permanent monitoring plots.	LBMF is establishing permanent monitoring plots in a pilot project in 2000.
Air and water temperatures are within the range of historic variation.	Not considered	—	—	—	—
Water depth and turbidity is within the historic range of variation.	Water turbidity	Watershed	Every 30 minutes	LBMF hydrometic stations.	LBMF operates 2 hydrometric stations. Turbidity measurement devices have not monitored water turbidity reliably. LBMF is tinkering with available technology.

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Criterion 3
Conservation of Soil and Water Resources — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Dissolved oxygen levels and water chemistry are within the historic range of variation.	Water nutrient analysis of N, P, K and dissolved oxygen.	Watershed level, interpretation at subregional level.	Infrequent sampling or intensive sampling considered.	In conjunction with LBMF 2 hydrometric stations.	LBMF runs 2 hydrometric stations in Clayoquot Sound. LBMF is considering data samplers, if available which would make continuous records a reality.
Rates of marine to terrestrial nutrient transfer.	Terrestrial nitrogen transfer.	To be developed.	To be developed.	To be developed.	$70,000 research project under way in 2000. LBMF is a partner to project.
Instream morphology of stream channels is maintained.	Stream channel morphology.	Site level or sub-basin.	2–5 years	To be developed.	Aerial photography to document major channel morphology. Implement program of stream audits is recommended. Consider remote techniques. No plans at present to implement measurement.
Instream function of stream channels is maintained.	Stream channel function.	Site level or sub-basin.	2–5 years	To be developed.	Consider remote techniques.
Trend and timing of events and seasonal streamflow are within historic range of variation.	Stream discharge.	Watershed	Every 30 minutes.	LBMF hydrometric stations.	LBMF operates 2 hydrometric stations.
Event and seasonal rainfall are within historic range of variation.	Precipitation	Watershed	Every 30 minutes.	LBMF climate stations.	LBMF operates 6 climate stations in large and small primary watersheds.

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Criterion 3
Conservation of Soil and Water Resources — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Ground water levels are within historic range of variation.	Not considered.	—	—	—	—
Extent of eel grass beds.	Eel grass bed distribution, health and reproductive success.	Site level intensive studies.	Annual intensive sampling.	To be determined.	No plans at present to measure this indicator.
Beach security/ patterns and security of drift logs.	Log loads.	Site level. Comparison of developed and undeveloped watersheds/sites	5 years	Aerial photography with ground checks. Methodology requires development.	No plans at present to measure this indicator. Pair developed and undeveloped watersheds.
Sedimentation around river mouths.	Sediment loads of estuaries and key beach areas.	Site level. Comparison of developed and undeveloped watersheds/sites	5 years	Aerial photo graphy with ground checks. Methodology requires development.	No plans at present to measure this indicator. Pair developed and undeveloped watersheds.
Increased fine sediment in water columns.	Not considered.	—	—	—	—
Aerial distribution (canopy cover) and density of nearshore marine vegetation.	Not considered.	—	—	—	—
Intertidal community structure and diversity is within range of natural variation.	Distribution and abundance of intertidal community.	Site specific	2 years	Sampling at developed sites such as log dumps. Simple line transects.	Specific studies of exploited species may be required for species of concern. No plans at present to implement measurement of this indicator.

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Criterion 3
Conservation of Soil and Water Resources — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Health and reproductive success of nearshore marine vegetation.	Annual and perennial kelp communities. Distribution, health and reproductive success.	Regional with site level intensive studies.	Aerial photography every 5 years, annual intensive sampling.	To be determined.	No plans at present to measure this indicator.
Recovery of sub-tidal exploited species.	Species of concern such as sea urchins, clams.	—	—	—	Local monitoring has begun as a research project ongoing for 4 years by LBMF partner.
Number of failures displaced per unit time between developed and undeveloped areas.	Rate magnitude and distribution of debris slides, debris movement and other mass movements.	Watershed or subregional.	Watershed or subregional every 5 years.	Aerial photography.	No plans in place to monitor this indicator.
Number of failures reaching mainstream.	Not a specific indicator.	—	—	—	—
Volume of soil displaced per unit time between developed and undeveloped areas.	Indicator not considered.	—	—	—	—
Amount of land deliberately owned from 'production'.	Indicator not considered.	—	—	—	—

Criterion 4: Forest Ecosystem Contributions to Global Ecological Cycles

Criterion 5: Multiple Benefits to Society

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Number of local jobs in forestry.	Indicator not considered.	—	—	—	—
Mechanisms for sharing the economic benefits derived from forest management.	Indicator not considered.	—	—	—	—
Wages and other benefits conform to national and/ or ILO standards.	Wages and benefits by forest-activity sector as compared to ILO or national standards.	Regional	Whenever they are reported.	Trend data, comparison. From employers or organizations such as labour relations board.	LBMF has no plans at present to collect this data.
Quantity and quality of beach debris.	Indicator not considered.	—	—	—	—
Soil compaction and degradation.	Indicator not considered.	—	—	—	—

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Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Implementation of scenic resources, recreation and tourism values inventory system with characteristics ascribed by the CSSP.	Quantity and quality of recreational and tourism opportunities.	Watershed and corresponding marine areas.	One time only.	Inventory adequacy assessment.	Examine available inventories to ensure values have been captured. Assess extent to which recreation and tourism considerations have been incorporated and valued in planning. Conduct regional inventories of recreation and tourism use levels and quality using existing inventories as a base line. LBMF has no plans at present to implement the measurement of this indicator.
Develop and review scenic resources, recreation and tourism values resource management plan.	Quantity and quality of recreational and tourism opportunities.	Watershed and corresponding marine areas.	One time only.	Inventory adequacy assessment.	Examine available inventories to ensure values have been captured. Assess extent to which recreation and tourism considerations have been incorporated and valued in planning. Conduct regional inventories of recreation and tourism use levels and quality using existing inventories as a base line. LBMF has no plans at present to implement the measurement of this indicator.

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Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent of forest plans that incorporate tourism and recreation values and visual landscape management plan recommendations.	Quantity and quality of recreational and tourism opportunities.	Watershed and corresponding marine areas.	2 years	Trend analysis. Examination of plans, comparison against inventory.	Examine available inventories to ensure values have been captured. Assess extent to which recreation and tourism considerations have been incorporated and valued in planning. Conduct regional inventories of recreation and tourism use levels and quality using existing inventories as a base line. LBMF has no plans at present to implement the measurement of this indicator.
Examples of different types of landscapes are retained in relatively unaltered states.	Indicator not considered.	—	—	—	—

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Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Recreational planning integrates needs of tourists and residents.	Quantity and quality of recreational and tourism opportunities.	Watershed and corresponding marine areas.	3–4 years	Trend analysis. Regional survey of local and tourism populations to assess satisfaction with visual resource quality.	Examine available inventories to ensure values have been captured. Assess extent to which recreation and tourism considerations have been incorporated and valued in planning. Conduct regional inventories of recreation and tourism use levels and quality using existing inventories as a base line. LBMF has no plans at present to implement the measurement of this indicator.
Availability of recreation opportunities are maintained.	Quantity and quality of recreational and tourism opportunities.	Watershed and corresponding marine areas.	2–3 years	Trend analysis.	Examine available inventories to ensure values have been captured. Assess extent to which recreation and tourism considerations have been incorporated and valued in planning. Conduct regional inventories of recreation and tourism use levels and quality using existing inventories as a base line. LBMF has no plans at present to implement the measurement of this indicator.

Criterion 5
Multiple Benefits to Society — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Maintenance of community social values.	Non-aboriginal cultural and archeological values, spiritual, scientific and educational values as defined in meaningful ways by community members.	Community basis in the region.	3-5 years	Trend data using values surveys. To be conducted in partnership with community vision groups and other agencies or organisations.	Ucluelet and area vision society held a workshop in November 1999. Indicators were identified but monitoring details have not been worked out. LBMF has no plans at this time to measure this indicator.

Criterion 6: Accepting Society's Responsibility for Sustainable Development

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Meet provincial and federal legislation requirements.	Indicator not considered.	—	—	—	—
Extent of Aboriginal participation in forest-based economic opportunities.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Number of Aboriginal communities with a significant forestry component in the economic base and diversity of forest use at the community level.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent of compliance with federal government guidelines for employment equity.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent to which firms operating in the Sound actively recruit First Nations in employment equity.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—

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Criterion 6

Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent of Nuu-Chah-Nulth participation in monitoring.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Area of Sound available for subsistence purposes.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Area of Sound available for continued cultural use.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Area of Sound available for continued resource use.	Indicator not considered.	—	—	—	—
People maintain spiritual links with the land.	Indicator not considered.	—	—	—	—

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Criterion 6

Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent of incorporation of Nuu-Chah-Nulth knowledge in cultural inventories.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Forest activities meet international standards regarding indigenous peoples.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Co-management of the sound is based on equal partnerships between Nuu-chah-nulth and the Province of BC.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
A working protocol for ecosystem co-management, based on mutual respect, is designed and maintained.	Indicator not considered.	—	—	—	—

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent or proportion of forest practices that incorporate TEK and hahuulhi.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	Active research project regarding hahuulhi and developing TEK indicator on-going with preliminary results expected in the fall of 2000.
Extent to which Nuu-Chah-Nulth are given opportunity to identify, locate and evaluate culturally important sites and areas prior to completion of planning processes.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Planning inventories are conducted in full consultation with Nuu-Chah-Nulth.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
All forest operations are conducted in full consultation with Nuu-Chah-Nuulth.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Training and education programs on ecosystem management processes and practices are made available to the Nuu-Chah-Nulth.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent to which forest and ecosystem workers and managers view educational videos or receive other orientations produced by Nuu-Chah-Nulth people about their perspectives on forest practices, impacts on the environment and their culture.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent of monitoring programs for the Sound undertaken in full consultation and with participation of Nuu-Chah-Nulth.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Extent to which environmental and social impact assessment procedures are used to value present and ongoing forest activities.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Nuu-Chah-Nulth sacred sites conserved or restored.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent to which damage to ecosystems, culturally important areas, and traditional resources occur, mitigative action is undertaken.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Archeological and historic sites, including those defined by oral traditions are conserved or restored.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Damages are compensated in a fair manner.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Extent to which restoration activities to damaged ecosystems are undertaken in full consultation and with participation of Nuu-Chah-Nulth.	List of First Nations related indicators have been developed but the necessary First Nations consultation to filter the indicators will not begin until the fall of 2000.	—	—	—	—
Sustained and adequate funding for ecosystem management.	Adequate funding with commensurate staffing levels is needed for sustainable management, particularly monitoring	Regional	Annually	Track formal budget contributions, in-kind and volunteer reported by budget activity.	LBMF has no plans to monitor this indicator at this time.
Planning and management are based on recent and accurate information.	Frequent reviews and updates of resource data is required to ensure a sound base for decision-making.	Regional	Bi-annually	Trend data. Assess individual components of information to determine if policy and planning are based on recent and accurate information.	LBMF has no plans to monitor this indicator at this time.

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Criterion 6

Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Changes in efficiencies associated with modified forest practices.	Monitor changes in efficiencies associated with alternative forest practices.	Stand level monitoring aggregated by forest harvest method/ retention level.	Continuously	Indicators: •Change in cost including road building per volume of trees removed. •Change in people/labour needs per volume of trees removed. •Change in time required for harvest per volume of trees removed. •Change in safety problems associated with different silvicultural prescriptions.	Comparison against measures from outside of Clayoquot Sound. LBMF has no plans to monitor this indicator at this time.
Number of communities with stewardship or co-management responsibilities.	Indicator not considered.	—	—	—	—
Stakeholder involvement in forest decision-making.	Inclusiveness — An on-going measure throughout planning and management activities.	Regional	Method 1 — Annually Method 2 — After each participation opportunity or annually.	Trend data Surveys or interviews.	Method 1 — Design of process against principals of open decision-making and range of interests who participated. Method 2 — Evaluation of stakeholders of the inclusivity of the process. LBMF has no plans to monitor this indicator at this time.

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Criterion 6

Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Status
Management staff and stakeholders recognize and respect the interests and rights of each other.	The degree to which stakeholders with diverse perspectives and interests are able to maintain an on-going relationship and negotiations with each other and with management staff based upon respect.	Regional	Annual	Trend data, surveys and interviews.	Can be completed in different ways: •willingness of stakeholders and management to accept public involvement as a necessary aspect of management •type and nature of interactions within and between stakeholders and management and the perception of the acceptability of these interactions. Degree of conflict, acceptability of that level of conflict and the conflict resolution processes in place within and between management staff and stakeholders. LBMF has no plans to monitor this indicator at this time.

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Criterion 6
Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Statusa
The decision-making processes must be transparent such that participants are confident that their opinions and values will be considered in the process and reflected in the final products.	Transparency in decision-making required as follows: •Agency mandate and purpose for public involvement is clear. •Lines of accountability and degree of decision-making delegated to stakeholders is clearly outlined. •Stakeholders know how their participation will be used and affect decisions. •Rationale for decisions and how stakeholder information was used in that decision.	Regional	Annually	Trend data using surveys/ interviews.	Possible methods include: •stakeholder surveys interviews of knowledge about and satisfaction with transparency of process •use of a proxy measure such as typology of public participation technique involving the dimension 'degree of decision making authority' LBMF has no plans to monitor this indicator at this time.

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Criterion 6

Accepting Society's Responsibility for Sustainable Development — continued

Indicator	Unit of Measure	Scale	Interval	Source of Data	Comments/ Current Statusa
Effective instruments for inter-institutional co-ordination on land use and forest management exist.	Need to manage across institutional boundaries. Monitor the effectiveness of inter-institutional bodies over a range of time scales and from different perspectives.	Regional	At the onset of monitoring and then every 3 years.	Measures — Number of inter-agency meetings, symposia, etc per year and participation by range of partners. Presence of inter-institutional bodies Effort of institutions to encourage coordination. Number of joint projects in progress. Broad institutional survey examining the existence of coordination, frequency, and LBMF has no plans to monitor this indicator at this time.	LBMF has no plans to monitor this indicator at this time.
Stakeholders have detailed and meaningful reciprocal background necessary to provide quality input into public participation processes.	Stakeholders should have timely and full access to information including background information, draft plans or decisions, justifications, scientific information and studies.	Regional	Annual	Trend data based on interviews or surveys.	Timeliness is important to ensure adequate participation. Reciprocity important to have access to background information from other stakeholders. LBMF has no plans to monitor this indicator at this time.

ABBREVIATIONS

CSSP: Clayoquot Sound Scientific Panel

ACTIVITIES OF THE MODEL FOREST NETWORK

The Canadian Model Forest Network is first and foremost a *network* and one of the key benefits to individual model forests is the opportunity to share information and approaches with other model forests across the country as well as internationally. Much of this networking activity takes place through relatively informal exchanges between two or more model forests and it is not possible to describe and document these exchanges in a report of this sort although the beneficial impacts have been substantial.

What is described in the following section are those networking activities related to local level indicators that have received direct support from the Canadian Model Forest Network. These are meetings, projects or initiatives that have been undertaken on behalf of the collective interests of all model forests across the country. In many cases the results of these initiatives will be of relevance and value to other interests who are also using local level indicators. Where reports, proceedings, etc are available this is noted in the text. Copies may be obtained from:

Canadian Model Forest Network Secretariat
Natural Resources Canada
Canadian Forest Service
580 Booth Street
Ottawa, ON K1A 0E4

Tel: (613) 992-5874
Fax: (613) 992-5390
E-mail: lli@modelforest.net
Web site: **www.modelforest.net**

Many of the reports, including reports listed as out of print, are also available for review at the offices of model forests across the country.

INITIAL NETWORK ACTIVITIES

The activities described in this section relate to some of the early attempts to get a better understanding of how criteria and indicators are particularly relevant to sustainable forest management. For the most part, the results from these initiatives are somewhat dated but they are described here briefly so as to give a context to the Model Forest Network's achievements in this area.

Indicators of Sustainable Development Workshop, Corner Brook, Newfoundland, October 1993

This workshop was one of the earliest networking meetings of the Canadian Model Forest Network and was also attended by representatives from the United States, Mexico and Malaysia who were interested in establishing model forests in their own countries. The purpose of the workshop was to identify and define practical methods of application of natural resource indicators as a measure of sustainable development.

MATERIALS AVAILABLE: Workshop proceedings, 124 pgs plus appendices.

Workshop on Social and Economic Indicators of Sustainable Development, Port Alberni, British Columbia, May 1994

The objectives of this workshop were to determine the importance of socio-economic indicators for the planning and management of Model Forests, as well as to determine how socio-economic indicators can be developed and integrated into existing decision-making systems for model forest management. In addition to keynote and panel presentations, eight working groups examined different dimensions of the topic.

MATERIALS AVAILABLE: Workshop proceedings, 25 pgs plus appendices.

Compilation of Literature on Indicators of Sustainable Development, 1997

A comprehensive literature review was carried out and the results of that review were assembled in three large binders and distributed to all model forests. These binders are now out of print.

Formation of the Local Level Indicators Working Group, 1997

As the Model Forest Network entered into Phase II of the Program in 1997, a decision was made to provide funding for specific strategic initiatives that were to help the Model Forest Network as a whole meet its key goals and objectives more effectively. One of the strategic initiatives identified from the beginning was to promote the development and application of local level indicators. The Network was seen to have a role to play in helping model forests make progress more quickly, to promote knowledge transfer between model forests, to facilitate the implementation of joint or collaborative initiatives, and to promote outreach beyond the Model Forest Network. In 1997, a Working Group was formed which has the overall responsibility for developing work plans for strategic initiatives related to local level indicators as well as guiding their implementation. Most of the initiatives described in the rest of this Section resulted from projects carried out as part of the strategic initiative related to local level indicators. In 1999, the name of the group was changed to the Local Level Indicators Strategic Advisory Committee.

WORKSHOPS, 1997–2000

As expensive as national meetings are in a country as vast as Canada, they have still proven to be perhaps the most effective way to share information among a sizeable group of people with specific interests in common. The Model Forest Network has hosted or participated in a number of significant workshops and conferences on the topic of local level indicators.

Conference on Criteria & Indicators and Certification; Workshop on Socio-Economic Indicators, Prince George, British Columbia, September 1997

The Model Forest Network participated in a major international conference on the theme of criteria & indicators and certification. This was followed by a workshop that focused in particular on the challenge of developing useful socio-economic indicators of sustainable forest management.

MATERIALS AVAILABLE: Workshop participants received a binder containing several background papers related to the topic.

Local Level Indicators Workshop, Rimouski, Québec, November 1997

This workshop involved a variety of participants from across the Model Forest Network and involved presentations and discussions culminating in a session in which the strategic plan developed previously by the Local Level Indicators Working Group was translated into a concrete action plan.

International Model Forest Network meeting, Wemme, Oregon, March 1998

One of the themes of this meeting, attended by most Canadian Model Forests as well as representatives from Model Forests around the world, was the effective use of indicators.

MATERIALS AVAILABLE: Workshop proceedings were published by the International Model Forest Network Secretariat and are available at www.idrc.ca/imfn.

Remote Sensing Course, Calgary, Alberta, August 1998

This technical short course was designed for practitioners and covered a variety of topics related to the use of remote sensing in gathering information about forests and forest management including the logic of multi-spectrum classification and mapping of land, satellite image preparation and preprocessing, visual interpretation and enhancement, updating to GIS, and working with file maps.

Biodiversity Workshop, Gananoque, Ontario, October 1998

The purpose of this workshop was to familiarize participants with the work being done by the Canadian Model Forest Network in the area of biodiversity research, preservation and conservation, and to provide information for the development of future initiatives of the Local Level Indicators Working Group.

REFERENCE: Canadian Model Forest Network. 1998. Gananoque Biodiversity Workshop Proceedings. 83 pgs.

Scenario Planning Workshop, Prince George, B.C., July 1999

This workshop was designed to enable model forests from across the country to familiarize themselves with the approach developed by the McGregor Model Forest using visualization tools to help stimulate discussion about how present-day management scenarios might result in significantly different future forest landscapes.

Canadian Model Forest Network Meeting, Halifax, Nova Scotia, September 1999

A major theme of this networking meeting (held in conjunction with an International Model Forest Network meeting and an international conference on sustainable development) was a comprehensive review of accomplishments to date on local level indicators across the Canadian Model Forest Network.

REFERENCE: Canadian Model Forest Network. May 2000. Proceedings of the Canadian Model Forest Network's Partnership Meeting. Halifax, NS, September 8–9, 1999. 70 pgs.

Criteria and Indicators for Naturalized Knowledge, Prince Albert, Saskatchewan, November 1999

This project was undertaken in order to stimulate further dialogue on how to respect traditional knowledge and incorporate it in forest management decision-making; as well as how best to use indicators to assist in this process.

REFERENCE: Northern Lights Heritage Services and L. Larcombe Archaeological Consulting. December 1999. Criteria and Indicators for Naturalized Knowledge: Framework and Workshop Proceedings. 40 pgs.

Local Level Indicators Workshops, Various Locations, June–December, 2000

The Model Forest Network is currently embarking on an ambitious series of workshops that will provide a showcase for model forest expertise and facilitate knowledge transfer outside of the Model Forest Network. The workshops are designed for the needs of participants who are already involved with local level indicators in their own district whether as planners, stakeholders or on-the-ground practitioners. Workshop sessions will be practical in their orientation so that participants leave with solutions to specific problems they are having or the tools to address those problems when they return home.

IMPROVING THE KNOWLEDGE BASE

The projects and activities described in this section are all aimed at improving the quality of the information available in order to promote better decision-making on the part of both individual model forests as well as the Model Forest Network. Several of the initiatives also have direct relevance to any agency using local level indicators. Copies of all studies and reports are available from the Model Forest Network Secretariat.

GLOSSARY: The Model Forest Network has prepared a glossary of key terms relating to local level indicators, criteria and indicators, and sustainable forest management. It is included in Appendix B.

LOCAL LEVEL INDICATORS BIBLIOGRAPHY: This is a regularly updated bibliography listing all reports or studies related to local level indicators that have been prepared by or on behalf of individual model forests or the Model Forest Network and that are available for general distribution. A copy of this bibliography is included in Appendix D.

Assessment of common indicators across the Model Forest Network

This report was prepared in order to identify those indicators that appeared most frequently in model forest indicator sets. This assessment helps to identify indicators that might be considered key and provides a basis for further discussion about developing common approaches to gathering data on these indicators as well as to provide some basic information on a possible core set of common local level indicators that could be used across the country.

REFERENCE: Holmes, Elizabeth. February 1999. *Local Level Indicators and Databases Common Across the Canadian Model Forest Network ... A View to Possible Information Sharing and Networking Opportunities*, revised version. 18 pgs plus appendices.

Local level indicators gap analysis

This report was prepared in order to summarize the state of development and application of local level indicators across the Model Forest Network as of March 1999 to identify needs, barriers and challenges, and to recommend options and opportunities for future actions, in particular through network strategic initiatives. The report offers fifteen recommendations with the overarching recommendation that the Model Forest Network focus on four strategic themes related to local level indicators:

a) facilitate knowledge transfer across the Model Forest Network;
b) foster leadership, excellence and continual improvement;
c) promote the broader dissemination and application of the local level indicators work being done by model forests; and
d) forge strategic linkages with other relevant initiatives.

REFERENCE: von Mirbach, Martin. March 1999. *The Canadian Model Forest Network: Local Level Indicators Gap Analysis*. 35 pgs plus appendices.

Communication Needs Assessment

This study was aimed at identifying specific target audiences that model forests hope to reach with information pertaining to local level indicators and to identify potential communication tools that could be developed by the Model Forest Network on behalf of all model forests.

REFERENCE: Rolls, B. Elaine. July 1999. *Local Level Indicators Communication Needs Assessment.* 34 pgs.

Development and Identification of Common Local Level Social and Economic Indicators Across the Model Forest Network (SIMFOR)

This major project developed methodologies to use Statistics Canada census data to report on a number of social and economic indicators of sustainability common across the Model Forest Network. In addition, a web server has been developed for Socio-Economic Indicators for the Model Forest Network (SIMFOR). The geospatial and non-spatial data on the server can be used to create socio-demographic profiles of communities, parishes, villages, First Nations reserves, local government districts, and unincorporated rural areas that are in model forests. An easy-to-use geospatial graphical user interface allows the user to access and visualize socio-economic data, statistics and profiles as they apply to model forests.

MATERIALS AVAILABLE: The user interface is accessible at the Model Forest Network's website (www.modelforest.net), under "Local Level Indicators." Also available is a final project report, Isosceles Information Solutions Inc. March 2000. *Developing a Web Server for Socio- Economic Indicators for the Model Forest Network (SIMFOR).* 41 pgs.

Reference Document

In 1999 the Local Level Indicators Strategic Advisory Committee identified the need for a major document that would compile and describe the information on local level indicators that the Canadian Model Forest Network has developed to date. The document would cover information on processes, protocols and methodologies developed for the identification, development, monitoring, reporting, use and application of local level indicators. The document would essentially be a "how-to" manual on local level indicators based on work done to date within the model forests.

This current report has been prepared in order to fulfill these expectations.

MATERIALS AVAILABLE: von Mirbach, M. June 2000. A Users' Guide to Local Level Indicators of Sustainable Forest Management: Experiences from the Canadian Model Forest Network. Canadian Model Forest Network, 242 pgs.

TRENDS AND COMMONALITIES

Each model forest within the Canadian Model Forest Network has developed a suite of local level indicators of sustainable forest management suited to its particular socio-economic, cultural and environmental conditions. Model forests have used a variety of approaches in the identification, selection and assessment of indicators. The diversity among model forests is a reflection of local circumstances and innovation resulting from different groups working towards a common goal.

TABLE 5.1: MODEL FOREST ABBREVIATIONS

WNMF — Western Newfoundland
NFA — Nova Forest Alliance
FMF — Fundy
BSLMF — Bas-Saint-Laurent
WCMF — Waswanipi Cree
EOMF — Eastern Ontario
LAMF — Lake Abitibi
MbMF — Manitoba
PAMF — Prince Albert
FtMF — Foothills
McMF — McGregor
LBMF — Long Beach

The observations made in this section are derived from a broad analysis of the work on local level indicators done by model forests across the country and provide an overview of a number of highlights, trends and commonalities from across the Model Forest Network. It is at the same time a record of the tremendous diversity of approaches followed by model forests as well as a compilation of some of the most important lessons learned.

In any overview of this sort, of course, it is not possible to fully reflect the myriad details and specific characteristics of particular activities. To get the full flavour of the diversity, creativity and accomplishments of the model forests it is necessary to go to the summaries contained in Section 3 of this report.

DIVERSITY IN THE MODEL FOREST PROGRAM

Any discussion of common threads needs to be understood in the context of the tremendous diversity that exists across the Model Forest Network. Three key aspects of that diversity are highlighted below.

Diversity of forest types

As can be seen in Table 5.2, most of Canada's major forest regions have one or more model forests associated with them.

TABLE 5.2: FOREST REGIONS OF CANADA AND ASSOCIATED MODEL FORESTS

Forest type	Model Forests
Coastal	LBMF
Boreal/Montane/Subalpine	McMF, FtMF
Boreal	PAMF, MbMF, LAMF, WCMF, WNMF
Great Lakes/St. Lawrence	EOMF, BSLMF
Acadian	FMF, NFA

From the State of the Forest Report 1998–1999

Forest regions that are not represented in the Model Forest Network are either relatively small in total area (the Columbian forests in the western Rockies and the deciduous forests of southwestern Ontario) or are primarily covered in vegetation other than forests (grasslands and tundra).

Diversity of ownership / management structures

Although ninety-four percent of Canada's forests are publicly owned, this figure doesn't accurately reflect the diversity of management regimes in existence throughout Canada. Below are a few relevant considerations that show the diversity of ownership, tenure and lease arrangements that exist across the Model Forest Network.

Provincial jurisdictions: Seventy-one percent of the total forest area of Canada is under provincial jurisdiction with each province having its own laws, regulations and policies with respect to both forest practises as well as tenure and lease arrangements. There are model forests (or model forest projects[1]) in nine of ten provinces so this diversity is well represented within the Model Forest Network.

National Parks: Canada's National Parks fall under federal jurisdiction and there are five Model Forests that have National Parks within their boundaries:

Long Beach	Pacific Rim National Park
Foothills	Jasper National Park
Prince Albert	Prince Albert National Park
Fundy	Fundy National Park
Western Newfoundland	Gros Morne National Park

These model forests have particular opportunities when it comes to using local level indicators since they are able to monitor ecosystem characteristics on adjacent lands that are subject to very different management interventions. They also face common problems in creating consistent data sets based on different forest inventories.

Ownership/lease arrangements: Over half of the model forests are on public lands that are predominantly managed under lease to one or a few major forestry companies; model forests that fall in this category include LBMF, McMF, FtMF, PAMF, MbMF, LAMF and WNMF with private sector leaseholders including Weyerhaeuser, Interfor, Canfor, Weldwood, Pine Falls Paper Co., Abitibi-Consolidated and Corner Brook Pulp and Paper. Four Model Forests have significant private lands holdings (EOMF, BSLMF, FMF, NFA). One Model Forest (WCMF) is led by Aboriginal interests and lies within the Cree territory as determined in the 1975 James Bay Northern Québec Agreement. These three arrangements — industrial lease, private lands, First Nation territory — offer their own challenges and opportunities, all of which are being explored within the Model Forest Network.

Diversity of partnerships

There is a third type of diversity that is particularly important to the Model Forest Program; namely the diversity of interests that participate in model forests and are involved in setting priorities, determining work plans, and carrying out projects. The total number of partners involved with each model forest ranges from 10 to over 90 but perhaps more impressive than the sheer numbers of partners is the diversity of perspectives that they bring. The list below provides a general overview of the range of interests present on Model Forest partnerships across the country.

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[1] Although Nova Forest Alliance is, strictly speaking, a Model Forest Project, no distinction is made in this report between it and the other model forests

Interests represented on Model Forest Partnerships

- Forest industry (large and small-scale)
- Federal government
- Provincial government
- Aboriginal communities
- Municipal government
- Environmental non-governmental organizations
- Academic and educational institutions
- Industry associations
- Professional associations
- Organized labour
- Development or tourism associations
- User groups

LESSONS LEARNED — USING PARTNERSHIPS EFFECTIVELY

Partnership-based approaches can be extremely rewarding ways to develop, refine and apply local level indicators. Involving diverse interests can:

- ensure that affected parties have meaningful input at the front-end part of the process;
- increase access to the knowledge and expertise of people with wide-ranging experience; and
- increase the likelihood that the results will be politically acceptable.

Building and maintaining diverse partnerships brings additional responsibilities and challenges, including:

- the need to take extra time to bring everyone up to speed; and
- the vital need to foster excellent communications at all times.

GETTING STARTED

Taking advantage of prior and parallel activities

When model forests in Canada began to explicitly address the challenge of developing and using local level indicators, they were not starting from zero. Model forests were already involved in a variety of projects, programs and initiatives that related in some way to the use of local level indicators. These had to be taken into consideration and, at the same time, helped to supply much initial momentum.

Model forest initiatives: Most model forests had already been in existence for about five years when they began to work with local level indicators in a systematic way. In that time they had undertaken a wide variety of projects, many of which had specific relevance to the use of local level indicators.

Research: Many model forests were involved in supporting various research projects and many of the researchers, especially those involved in biodiversity research, are well acquainted with the use of indicators since concepts such as "indicator species" were already in widespread use in forestry circles. Other model forests (such as EOMF and McMF) had done prior background research into the applicability of the CCFM indicators to their model forest.

Integrated Resource Management Plans: Several model forests were engaged in developing management plans that aimed to go beyond traditional timber management plans by incorporating diverse values at the front end of the planning process. Any program to monitor the implementation of these plans will sooner or later have to develop a set of indicators to measure and report on.

Adaptive management / Scenario planning: A number of model forests (such as McMF) were explicitly engaged in applying principles of adaptive management across a range of forest values. One crucial step in adaptive management is to predict or project into the future the desired values that present-day actions are intended to move towards. This is normally done on the basis of quantifiable indicators. So whether one is constructing computer-based scenarios or discussing a future vision of the forest, sooner or later it is necessary to use indicators in order to communicate that vision and assess whether or not it is coming closer to reality.

Other initiatives: Besides the national and international external factors discussed in Section 2 of this report, there were also a number of related initiatives taking place in the province or district.

Management planning: Forest managers are required under provincial legislation to produce management plans on a regular basis. The planning frameworks and requirements for these plans are constantly evolving and are increasingly focussed not only on what will be done but also on how it will be possible to assess whether the results actually met the expectations. As a result, indicators are becoming increasingly important in management planning and model forests have proven to be well equipped to help make the link.

Forest certification: There are currently two forest certification schemes that have generated significant interest in Canada (developed by the Forest Stewardship Council and the Canadian Standards Association) as well as a generic Environmental Management System (ISO 14001). The CSA SFM standard explicitly requires the development of indicators using the CCFM framework, but both the ISO and FSC systems require ongoing monitoring which cannot be done effectively without adequate indicators.

Provincial initiatives: A number of provincial initiatives related to indicators were getting underway at about the same time as model forests began work on local level indicators. All provinces are addressing their responsibilities to feed into national reporting processes. Some provinces are also bringing indicators to the fore through initiatives such as writing them into the requirements of district management plans (Newfoundland) or using indicators to compile and publish regular State of the Environment reports (Alberta).

Monitoring: The Long Beach Model Forest has since its inception been collaborating closely with other agencies in the region that were established in order to monitor ongoing activities in the region and their impact.

Other indicators frameworks: The Waswanipi Cree Model Forest lies within the James Bay Cree territory which has a comprehensive set of forest management indicators that were developed for the James Bay Advisory Committee on the Environment and that apply to the entire territory covered by the 1975 James Bay Northern Québec Agreement.

LESSONS LEARNED —
BUILDING ON EXISTING WORK

Take full advantage of prior or parallel work being carried out. Instead of reinventing the wheel, much of this work can be reviewed, modified where necessary, and validated in its new application. This not only saves time and money, but also helps to assure people and agencies that their previous efforts are fully valued.

Defining a purpose for using local level indicators

This has proven to be a particular challenge for model forests due to the wide range of possible applications for local level indicators and the diversity of the partnerships involved. At the outset, many people involved in model forests had only a vague idea of what "C&I" was all about and why it was important. Many others *thought* they understood why indicators were important but they may have only had part of the picture. For example, a university researcher may be keenly interested in pursuing a hypothesis about how some very specific forest attribute may serve as an indicator of an important habitat niche in the ecosystem while an industrial manager may be predominantly concerned with meeting the needs of certification requirements without incurring undue expenses. Both perspectives are valid but neither offers a complete picture and the challenge for model forests has been to incorporate these and many other expectations into a particular work plan.

The result of these confusions and differing expectations was that the Phase II proposals written by model forests in early 1997 are, for the most part, quite vague on the topic of using indicators. They demonstrate an awareness of a wide range of possible uses for indicators (identify trends, support certification initiatives, utilize traditional knowledge, demonstrate innovations and sustainability, link to policy goals, etc), but tend to be short on the specifics of how to actually reach these goals. Most model forests have in the intervening years moved well beyond what is stated in their work plans.

LESSONS LEARNED — DEFINE YOUR OUTCOMES

Get a clear idea as soon as possible in the process of what the end product or outcome will be. This will influence how indicators are selected, refined, and used.

Forming a core team

Model forests are by their very makeup predicated on the idea of working collaboratively so the task of developing local level indicators was not simply handed off to a resident expert or consultant to carry out. Most model forests formed a multi-stakeholder committee or working group to lead their work on local level indicators and to provide overall guidance. This is a normal way for model forests to work since it allows people with a special interest in that subject area to focus on it, and frees the larger partnership committee or board from having to deal with every step of the process. Some of these committees (e.g., NFA) have been very "hands-on", meeting on a regular basis, taking a direct interest in every aspect of the work, and rolling up their sleeves to share in the work. Others have functioned more as steering committees, providing guidance and oversight to the staff or contract personnel who did the actual work. Others (e.g., WNMF) have functioned at times as a "hand-on" committee and at times as a steering committee. And some model forests (e.g., EOMF) took an existing committee and assigned it new responsibilities related to local level indicators.

Fundy Model Forest took the exceptional step of revamping its entire committee structure to reflect the CCFM framework with one committee per criterion.

At some model forests the responsibility for guiding work on local level indicators has not been delegated to a committee but is retained by the board or partnership committee (e.g., WCMF) or else delegated to a staff specialist who then reports to the Board (BSLMF). Even where there is an active and strong committee, dedicated staff or contractual help is needed to provide administrative support and overall coordination without which the local level indicators initiative can get stuck in the doldrums.

LESSONS LEARNED —
COMMITMENT AND MOMENTUM

- It is vitally important to have buy-in and commitment up front. A committee can be one way to do this but special efforts may be needed to ensure that the organization as a whole is fully committed to the process.
- It can be helpful to work with other agencies that are also working towards using local level indicators but be aware of the fact that different organizations may have different time lines.
- Administrative support is critical in order to ensure that momentum is maintained.

Involving others

Model forests have learned from experience that simply having a broad-based committee is never enough. Forest management issues are inherently public interest issues and if crucial decisions are made behind the closed doors of committee rooms, without ever being tested out with a broader constituency, then the acceptability of those decisions is likely to be called into question regardless of who was on the committee. This is why almost every model forest has held a large workshop on local level indicators at some point in the process.

These workshops typically involve anywhere from 30–70 participants who spend 1–2 days focussing exclusively on local level indicators. Model forests typically send invitations to their full contact list and strive to be inclusive rather than selective. Specific outcomes are tailored to the specific needs at the time, whether to validate a set of goals and values, select potential indicators in break-out groups, identify monitoring requirements and commitments, etc. Some model forests held workshops at the beginning to launch their local level indicators initiatives, while others waited until they had something more substantive to bring forward. However, all workshops share several common goals: to give participants a better understanding of local level indicators; to keep the broader constituency informed; to raise the profile of the model forest's work on local level indicators; to solicit views, opinions and guidance on the next steps in the process; and to build buy-in and commitment to the process.

LESSONS LEARNED —
USING WORKSHOPS FOR OUTREACH

- Workshops can be an effective way to involve as many people as possible.
- Special efforts may be needed to involve groups or interests whose past involvement has been relatively weak.
- Workshops should strive for adequate balance in representing environmental, economic and social interests.
- It can be helpful to identify appropriate values at the outset since this can build buy-in to the process.
- Neutral facilitation at workshops can be very useful.
- There needs to be adequate follow-up to ensure that everyone remains informed.

SELECTING INDICATORS

Determining a starting point

All model forests (except WCMF, as discussed below) used as a starting point the six criteria developed by the CCFM to apply at the national scale. Some made minor changes to the wording of the criteria. Many, but not all, model forests explicitly addressed the sub-criteria or "critical elements".

When it came to developing a "first cut" of indicators to use as a basic starting point for further refinement, the approaches followed by model forests have been more diverse. Several different approaches are briefly described below.

Start with the CCFM set. In this method, each of the 83 CCFM indicators is evaluated for its potential relevance or practicality at the local level. This approach was used at FMF, BSLMF and EOMF with somewhat different results coming out of each analysis. (Although EOMF started with this approach, it later moved towards considering an expanded list of initial indicators.)

Start with another set. NFA started with the indicators that had already been reviewed and selected for use by FMF. This was in keeping with its close working relationship with FMF and helped that group save considerable time in the early stages of the process. WCMF has at its disposal an entirely different set of indicators developed for the James Bay Advisory Committee on the Environment and using a different set of criteria.

Start with a "compilation set." In this method someone compiles a lengthy list of possible indicators from a variety of sources available at the time. The CCFM set is always part of this compilation set, which includes other indicators from regional and provincial indicator sets, indicators from other model forests and/or from published literature. This approach was used in LBMF, PAMF, LAMF and EOMF.

Start with a "blank slate." Several Model Forests (McMF, FtMF, MbMF and WNMF) did not start with an actual list of indicators in front of them to serve as a checklist but built their own from scratch. Three of them (FtMF, MbMF and WNMF) built their indicator sets around values and goals that had been previously identified and worked to identify indicators that would be relevant to those values and goals. McMF began with the intention of using the indicators to drive a computer modelling tool and therefore focussed on indicators that met these specific requirements. In all cases, participants presumably brought their own knowledge of other indicator sets into the process.

One characteristic of all of the above approaches is that model forests have not felt constrained or restricted by whatever set of indicators they are starting from. Model forests can and have both modified and reworded indicators to suit their circumstances or else referred to indicators from other sources where it has proven to be helpful.

LESSONS LEARNED — SELECTING INDICATORS

There is probably no single "preferred" way to start evaluating indicators for their potential relevance at the local level. The choice of methods should be based on the expertise available and on the method that is best suited to generating commitment and buy-in.

Refining the indicators

The task of further refining the indicators and winnowing out inappropriate ones usually fell to a small committee or working group (McMF, MbMF, EOMF, FMF, NFA, WNMF). In some cases an individual or consultant was given this task (FtMF, PAMF, LAMF, BSLMF) but in these cases the results were typically reviewed and modified by a larger committee. Some model forests used a specific scoring or ranking system (LBMF, NFA) while others took a more informal approach.

Each model forest used some set of criteria to screen indicators to determine their appropriateness at the local level. Most of those criteria are listed in the write-ups of individual model forests in Section 3. There are considerable similarities and overlaps among the screening criteria used, and general consistency with other criteria that have been put forward. Table 5.3 provides a synthesis and amalgamation of the screening criteria used across the Model Forest Network. The questions included in the table give an example of the type of issue it is intended to address.

Further refinement and filling gaps

Once a screening has been carried out on an initial indicator set there will usually be a sharply reduced set of indicators. It will then be necessary to further assess this entire set of indicators. This involves two tasks:

1. **Assessing "clusters" of indicators.** This is usually done by assessing a group of indicators that relate to a particular criterion, critical element, value or goal. Do the indicators as a whole give a reasonably comprehensive measurement of the particular criterion, critical element, value or goal?

   This assessment often identifies gaps — elements of the framework that are not covered satisfactorily or at all. Many model forests identified gaps in indicators related to public participation, traditional knowledge, and socio-economic factors. These gaps can be addressed by revisiting the indicator set, carrying out further research and field testing, conducting a survey, or launching specific initiatives aimed at engaging interests necessary to help in developing appropriate indicators. The many examples of model forest activities that help to address these gaps can be found throughout Sections 3 and 4.

   There are also cases when assessing clusters of indicators can help to resolve problems with individual indicators since a group of indicators can often prove to be more relevant, reliable and sensitive than each indicator on its own.

2. **Assessing the entire suite of indicators.** Sooner or later it is necessary to evaluate whether it is feasible to collect information on the entire suite of indicators, considering realistic constraints on financial, human and technical resources. This is often done at the time that data gathering responsibilities are discussed (covered in more detail in Section 5.4). Whenever such an assessment is done, it inevitably results in intense pressure to simplify the indicator set.

TABLE 5.3: CRITERIA TO EVALUATE INDICATOR QUALITY AND APPROPRIATENESS

Credibility and Meaningfulness

Relevant	Does the indicator tell us something meaningful about SFM?
Reliable	Is it relatively free of factors that introduce "noise" when it comes to interpreting indicator measurements?
Responsive	Is it responsive to management actions?
Sensitive	Is it sensitive to change, and will it show trends over time?
Predictable	Can future indicator levels be predicted with reasonable accuracy?

Practicality

Available	Is data for this indicator currently available?
Affordable	Can data be compiled or collected at reasonable cost?

Validity

Measurable	Is the indicator measurable at an appropriate scale, and with sufficient accuracy to be useful?
Understandable	Is the indicator and its relevance readily understandable to an informed, non-technical reader?
Cost-effective	Is the cost of measuring this indicator justified by the value of the information it provides?
Commitment	Is there the necessary commitment to measure, monitor and report on this indicator?

LESSONS LEARNED — SCREENING INDICATORS

- Very few indicators ever "pass" all screening criteria so there are always tradeoffs involved in selecting the best available indicators. There is no "perfect" set of indicators.
- These tradeoffs are not easy to make since they require balancing widely different interests (credibility, comprehensiveness, affordability).
- Typical indicator screening processes are often better suited for assessing ecological indicators than social or economic indicators.
- Although qualitative or descriptive indicators may "fail" several of the normal criteria used to screen indicators, there are often situations when descriptive indicators are either more meaningful or more practical than any others.
- Indicator sets are rarely static and are likely to be constantly revised and refined as people gain experience in working with them.
- A helpful approach can be to start small, ensuring the initial set of indicators will actually be used, and then to subsequently build a more comprehensive set.
- It is important to obtain buy-in to the indicators that will be used.

COLLECTING DATA ON INDICATORS

Having an indicator is not the same as having good, accurate, up-to-date information for that indicator. Data collection is obviously an essential component of local level indicator work, vital both for initial reporting as well as for ongoing monitoring. Model forests, in collaboration with their partner organizations, are exploring ways to collect and analyse data to effectively and efficiently monitor their local level indicators.

Identifying data requirements

Many model forests have carried out an assessment of their set of indicators to determine what is involved in actually gathering information for each indicator. This was done to varying degrees of detail and at different times — some did this assessment at the same time that the indicators were being screened while others waited until after they had developed a refined set of indicators.

Table 5.5 offers a generic data requirements checklist combined from the various checklists in use across the Model Forest Network. The information requested in the checklist is normally completed for each appropriate indicator.

Data collection work plans

Model forests have demonstrated quite a range of approaches to data collection. Some (e.g., EOMF, FMF) determined to put their initial efforts into gathering data that already exists while others are focussing more on setting up programs to carry out field monitoring. Collecting new data in the field is relatively costly, of course, and those model forests that have gone down that road have generally done so in collaboration with other agencies that have responsibility for ongoing monitoring (e.g., LBMF and assorted agencies in Clayoquot Sound).

LESSONS LEARNED — GATHERING DATA

Although responsibility for gathering data can be divided up among several agencies, there needs to be significant dedicated resources assigned to the task of overall coordination.

Monitoring responsibilities

It has not been easy for model forests to develop and implement work plans for ongoing monitoring and reporting. Several model forests explicitly avoided taking on any responsibilities that would extend beyond the end of Phase II of the Program in 2002 believing that if a monitoring program was to be viable it would have to stand on its own. Other model forests did conclude that they could play a prominent role in the early stages to co-ordinate data collection, to work the bugs out of the data collection protocols, to help commission the surveys or research necessary to fill in prominent gaps, and to produce a first State of the Forest Report.

Overcoming challenges in data collection

Almost inevitably, once a thorough assessment is made of what is involved in collecting data on the full range of indicators, everyone's jaws drop with the enormity of the task. This usually results in pressure to simplify the data collection requirements. Table 5.4 outlines some of the methods that have been used by model forests to simplify data collection.

When data gathering requirements are simplified, there are generally compromises to be made in the overall precision of the data. For this reason, it is usually helpful to have the entire committee involved at all stages in the process. Everyone needs to be involved in making these trade-offs so they can see the big picture rather than simply the handful of indicators that they may have a particular professional interest in.

Once data collection actually gets underway there are usually a number of previously unforseen problems that arise. Table 5.6 reviews some of the problems along with suggested solutions that have been identified within the Model Forest Network. It is important to note that most model forests are still at a relatively early stage in their data collection work so undoubtedly more problems and innovative solutions will be identified in the coming months.

TABLE 5.4: APPROACHES TO SIMPLIFYING DATA COLLECTION

Reduce the number of indicators	The challenge is to some up with fewer but smarter indicators; namely indicators that provide rich insight into SFM rather than simply relevant information.
Start by collecting data on a partial set	This approach has the advantage of allowing demonstrable progress to be made as soon as possible which will help to build support for future refinements.
Make better use of existing data	Often indicators can be revised slightly to take advantage of existing data. For example, if population levels for indicator wildlife species are not available and too costly to obtain, other indicators may be substituted such as hunter returns, relative abundance or available high-quality habitat.
Use sampling methods to replace direct measurement	This can be done either by selecting "case study" areas (such as particular watersheds) or by using sampled data rather than full measurement.
Explore new methods	Remote sensing offers the potential to collect certain data across large areas.

TABLE 5.5: GENERIC CHECKLIST FOR DATA REQUIREMENTS

1. General information

Higher-order information	criterion, critical element, etc, that the indicator relates to
Indicator	
Unit of measure	if the indicator if not already expressed in this way
Description	simple description of why the indicator is relevant/important

2. Relationship to management planning

Value or goal	value or goal associated with the indicator
Objective or target	objective, target, threshold, range, etc
Policy requirements	policies, legislation or regulations that relate to the indicator

3. Measurement and monitoring protocols

Scale	the scale that is most appropriate to that indicator
Interval	the frequency with which the information will be gathered and updated
Precision required	degree of precision required
Sampling protocol	how the data is to be gathered (sample plots, survey returns, etc)

4. Data specifications

Location	agency that has the data
Format	technical specifications if computerized
Availability	note any restrictions
Reliability	note any gaps or inconsistencies
Progress to date	include current status
Baseline	any baseline measurements that are available
Research needs	note work that needs to be done to address inadequacies

5. Responsibilities

Lead person or agency	responsible for ensuring that the data is acquired in a usable format
Project leader	for field work; this person may be different from the above
Data management	agency responsible for data storage on an ongoing basis
Cost	direct and in-kind; labour, equipment and other
Agency(ies) to bear or share costs	

TABLE 5.6: CHALLENGES IN DATA COLLECTION

Technical challenges

Challenge	Example	Possible Solution or Comments
Data not available at the spatial scale required	Hunting statistics are kept for regions with different boundaries than the forest district	It is often unnecessary to insist that the scale be consistent for all indicators and usually preferable and more meaningful to report on data at the scale at which it's actually being collected.
Inconsistencies in temporal scale making it impossible to set a common baseline	Latest timber inventory is for one year, latest Stats Canada data is for another year, etc	Usually having a common baseline is less important than using the best and most recent information available.
Technical incompatibilities in data sets	Cannot merge National Park and provincial forest inventories	This seems to be a more serious problem in some regions than in others. In amalgamating WNMF / Gros Morne inventories, the problem is simply one of merging compatible inventories whereas in Foothills/Jasper Park there are significant differences in the level of detail.

Human challenges

Challenge	Example	Possible Solution or Comments
Not enough time and low priority	Some people are "keepers" of essential data but providing it in a useful format can be time-consuming and these are busy people with other work to do	Make the point that effective use, interpretation and distribution of this information will add to the perceived significance of the task of gathering it and thereby strengthen the agency that maintains and provides the information.
Reluctance to release information for fear of misuse	"That information could be misinterpreted"	All indicators on their own run the risk of being misinterpreted. Suppliers of information can be offered assurances that they will be able to review any draft reports before they are widely distributed
Reluctance to surrender proprietary information	This can be due to competitiveness issues, or simply a case of "data hoarding"	Obtain explicit agency buy-in to the overall set of indicators and data gathering plan at a sufficiently high level to ensure agency commitment and compliance.
Reluctance to release "negative" information	Statistics on enforcement issues or employment trends	It is important to stress that each indicator will be used as part of a comprehensive and broad suite, that SFM is too complex to ever expect all indicators to show trends in the same direction, but that the purpose of the exercise is to use detailed indicator data to see the "big picture" rather than to focus narrowly on particular issues.

USING AND REPORTING ON INDICATORS

When model forests developed proposals for Phase II of the Model Forest Program in late 1996, they were expected to put together work plans for developing and measuring local level indicators of sustainable forest management but they were not specifically told why except in very general terms. In hindsight this has had a curious impact on how model forests have dealt with the challenge. On the one hand, it left many model forests somewhat adrift at first — their Phase II proposals awash in vague generalities, their stakeholder groups stubbornly maintaining their own divergent views about what it all meant, and their staff swimming in confusion over it all. (To be fair, these tendencies were widespread in all sectors of the forestry community in Canada and internationally during 1996–1998.) On the other hand, it provided model forests with a "blank slate" on which to write their own story of how to use local level indicators. This freedom to explore resulted in a considerable degree of creativity and innovation across the Model Forest Network. What follows below is a brief synthesis and recapitulation of what model forests are using local level indicators for and how.

Management planning

Almost all Model Forests indicated an interest in using local level indicators in management planning. This is interpreted differently by model forests across the country, however. Some maintain that without managerial authority or jurisdiction the most they can do is to assist their managerial partners to incorporate local level indicators in *their* management plans. Other model forests are indeed engaged in developing their own plans either on behalf of their partners or as a high-order "vision plan" that, while not legally binding, would seek to elicit everyone's best efforts towards sustainable forest management. Whichever type of management plan it is, there is in all cases a recognition that indicators are an essential element if there is to be any effective monitoring of the plan's implementation and ultimate impacts.

Scenario planning

Scenario planning is a structured process in which forest stakeholders join together to consider "what's possible" in an uncertain future and what implications might arise from different management strategies. The process is enhanced through the use of advanced strategic and operational computer models that forecast measurable indicators which are used to portray the scenarios, the associated implications of each on various resource values, and the resulting landscape patterns. Several model forests listed this as a priority, and two (McMF and FMF) have implemented it to the point of developing actual scenarios or future forecasts of the forest estate. Indicators are clearly crucial here since it is precisely those indicator values that are projected into the future with different scenarios reflecting the predicted impacts of various management interventions. The approach used by McGregor has resulted in a model that can produce visualizations of the forest and landscape appearance into the future while Fundy's method has focussed more attention on using various scenarios to engage as many stakeholders as possible in discussing and debating their preferred future forest.

Best Management Practises

This is also part of management planning but the attention is focussed specifically on setting targets, thresholds or preferred ranges for specific indicators. Several model forests (e.g., MbMF, LAMF, FMF) have taken steps in this direction. Others (e.g. FtMF, WNMF) are doing something similar by encouraging their stakeholder groups to discuss and agree on specific, measurable goals and objectives for everyone to implement.

Forest certification

Under all three of the major certification systems in use in Canada — CSA, ISO and FSC — what is certified is the environmental management system which is generally part of the management plan. In this sense using indicators in forest certification is little different from using indicators in any other management plan. However, both the FSC and the CSA systems have specific forest monitoring requirements. The CSA explicitly requires use of the CCFM framework while FSC indicators vary with the particular set of standards in use and are often implicit rather than explicit. ISO does not have a forestry standard so there are no ISO forest indicators but there is still the requirement to monitor and report on the implementation of the environmental management system and this is typically done with indicators. Although model forests indicated an interest in using indicators for forest certification, most are simply playing a supporting role towards the efforts of their partners. EOMF is a notable exception and has recently taken a leadership role in helping to encourage and build the capacity of private woodlot owners in the area to achieve FSC certification.

State of the Forest Report

Five model forests (LAMF, EOMF, FMF, NFA, WNMF) have declared an intention to issue a comprehensive State of the Forest Report, reporting publicly on the information collected across the full range of indicators. EOMF's first State of the Forest Report was released in 1999 and uses a format and style that is roughly comparable to the Technical Report prepared at a national level by the Canadian Forest Service for the CCFM (CCFM 1997)[2].

LESSONS LEARNED — USING INDICATORS

Model forests have learned that there are a variety of valid uses for local level indicators. Indicators can be used for:

- improving knowledge and understanding about sustainable forest management by guiding further research initiatives;
- management planning including the use of Best Management Practices and forest certification; and
- communications, outreach, and knowledge transfer through reporting and broader application.

This diversity of uses demonstrates the importance of local level indicators to the practice of sustainable forest management.

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[2] Canadian Council of Forest Ministers, Criteria and Indicators of Sustainable Forest Management in Canada: Technical Report, Natural Resources Canada, 1996, 137 pgs.

Communications, discussion and dialogue

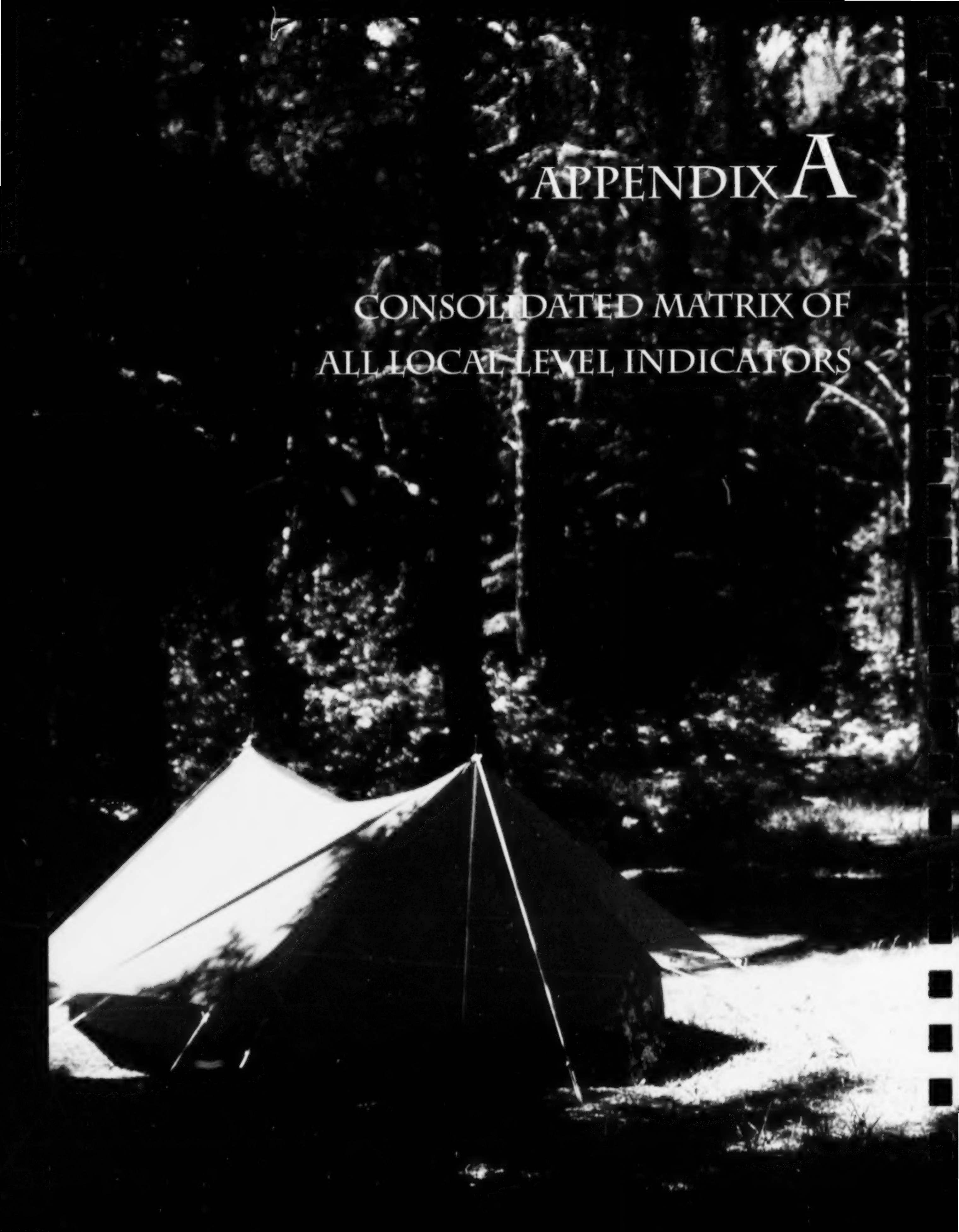
Most model forests are integrating information about local level indicators in their communications programs. For example, LAMF developed a "science series" describing how indicators can be used to measure attributes of sustainable forest management, with one article per criterion. This series has been adapted and used by both WNMF and EOMF. Other model forests have used more informal means to communicate about sustainable forest management through describing and interpreting local level indicators.

Broader application/knowledge transfer

The Model Forest Network seeks to ensure that its experience is disseminated beyond the boundaries of specific model forests and its work on local level indicators is no exception. Some knowledge transfer initiatives involve a direct link from a model forest to another forest management district such as Fundy's transfer of its expertise on local level indicators to Nova Forest Alliance or McGregor's work in a number of Tree Farm License districts in British Columbia. Other knowledge transfer initiatives are more broad in their scope. For instance, WNMF developed a generic "Practical Guide" that is designed for use throughout the province and is being incorporated into district and private sector planning processes throughout Newfoundland and Labrador. In another example, FtMF is providing assistance in the development of indicators to the Northern East Slopes Sustainable Resource and Environmental Management Strategy, an ambitious regional planning approach that will bring together four provincial government departments in Alberta to integrate economic, environmental and community values in sustainable management of resources and the environment. In this example the knowledge transfer is extending beyond the forestry sector to influence other resource management fields.

APPENDIX A

CONSOLIDATED MATRIX OF ALL LOCAL LEVEL INDICATORS



Ecosystem Diversity

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Percent and extent of area by forest type and age class					x	x	x			x	x
Area of each forest type, by age class	x										
Distribution of cover types and age classes per cover type				x							
Composition of the forest in terms of Forest Ecosystem FEC V-types							x				
Percentage and extent in area of forest community and age class by ELC, relative to pre-European settlement condition and total forest area			x								
Area of forest land by land use designation									x		
Identification and protection of local sites of significance					x						
Percent and representativeness of forest types in protected areas						x					
Percent and representativeness of protected areas within the site district(s) of which the unit is a part			x								
Proportion of each eco-region in protected status							x				
Forest management activities, not set out in the management plan, in rare or fragile ecosystems (alder stands, denuded, semi-denuded, islands and islets)				x							
Protected areas	x										

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Criterion 1
Ecosystem Diversity — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Forest fragmentation	x										
Special features status									x		
Level of forest fragmentation and connectedness of forest ecosystem components			x								x
Level of forest fragmentation and connectedness						x					
Surface area and size distribution of areas located more than 1,5 and 10 km from roads						x					
Amount and percentage of interior forest space					x						
Change in roadedness per volume of trees removed associated with modified forest practices											x
Patch-size distribution by natural disturbance type by landscape unit by age class							x			x	
Size and distribution of contiguous patches											x
Amount and distribution of edge											x
Relative distribution of seral stages following natural (burned) and human (harvested) disturbances								x			
Relative distribution and diversity of vegetative species following natural (burned) and human (harvested) disturbances.								x			

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Criterion 1

Ecosystem Diversity — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Percentage productive area > 100 years in Forest Ecological Networks										x	
Percentage productive area < 3 m height in Forest Ecological Networks										x	
Nature of patch size and shape resulting from harvesting approximating natural landscape patterns							x				
Changes in patch size distribution in relation to natural patterns of disturbance											x
Average area of total clear cut				x							
Naturally regenerated areas relative to reforested areas				x							
Abundance and composition of residual stand structure							x				
Changes in amount and complexity of vertical habitat structure											x
Abundance of coarse woody debris, snags, etc.											x
Density of roads							x		x		
Percent of proposed harvest blocks subject to pre-harvest assessment							x				
Total forest area by percent and extent in all the combinations of forest cover types and maturity classes		x									
Area of forest permanently converted to non-forest land use, e.g., urbanization. Also includes agriculture and golf courses.		x									

Species Diversity

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Proportion of pre-harvest assessment crews trained in the recognition/ identification of VTE species and habitat							x				
Proportion of identified VTE for which appropriate management action have been taken							x				
Number of species classified as extinct, extirpated, endangered, threatened or vulnerable			x		x	x					
Number of known forest-dependent species classified as extinct, extirpated, endangered, threatened or vulnerable relative to total number of known forest-dependent species											x
Populations levels/indices of vulnerable, threatened and endangered species						x					
Forest management activities, not set out in the management plan, in the habitat of threatened, vulnerable or exotic species				x							
Diversity of bird populations				x							
Population size and reproductive success of species at risk											x
Population size and reproductive success of species dependent upon interior forest conditions											x
Population levels of caribou	x										
Population levels/indices of selected species or guilds			x		x				x		
Relative abundance, species richness and diversity of migratory songbirds								x			
Area and percent of each forest stand type protected								x			

Criterion 1
Species Diversity — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Percent of Prince Albert Model Forest area within 1 km of an active access road								x			
Habitat quality and quantity for selected species			x				x		x		
Number of known forest-dependent species that occupy only a small portion of the former range in the region.			x								
Number of habitat units for the winter range of Owl Lake Woodland Caribou herd							x				
Continued partnership in the Integrated Forestry/Woodland Caribou Management Committee							x				
Percentage productive area < 80 years by Caribou Zone										x	
Distribution of Newfoundland Marten	x										
Percentage productive area < 3 m height by Caribou Corridor										x	
Area harvested in grizzly habitat zones										x	
Exploitation rates of biological resources									x		
Number of known forest-dependant species classified as endangered to vulnerable and the number of recovery plans for these species.		x									
Area of habitat suitable and available for selected species and/or species guilds		x									
Amount of area with natural cover type suited to the Acadian Forest Region and Site		x									

Genetic Diversity

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Adherence to seed zones						x	x				
Implementation of an ex-situ/in-situ gene conservation strategy			x								
Changes in population, genetic diversity and structure and gene flow for selected species			x								
All naturally occurring species are maintained within sub-regions											x
Absence of species or visible subspecies from formerly populated areas											x
Degree of range reduction of sensitive species											x
Population size and reproductive success are adequate to maintain levels of genetic diversity											x
Utilization of commercial tree genetic material in tree propagation							x				
Size of parent population having produced regeneration						x					
Distribution of commercial tree establishment from provincial tree improvement sources, natural seed collection within seed zone and regeneration from local site seed source							x				
Changes in genetic diversity of species undergoing selective pressures											x
No significant changes in gene frequencies in trees											x

CRITERION 2: MAINTENANCE AND ENHANCEMENT OF FOREST ECOSYSTEM CONDITION AND PRODUCTIVITY

Incidence of Disturbance and Stress

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Area and frequency of distribution of clear cut by size						x					
Habitat quality and quantity for selected species						x					
Area of insect, fire and logging disturbance	x										
Population levels of selected species						x					
Area of disturbance, by type and severity					x						
Area and severity of insect infestations			x				x				
Area of extreme and high spruce bark beetle hazard stands by period										x	
Areas recommended for treatment from MNR insect surveys							x				
Levels of disease outbreaks			x								
Tree insect and disease infestation									x		
Forest fire number, areal extent, spatial distribution, frequency and shape								x			
Area and frequency distribution of fire disturbance			x			x	x				
Fire occurrence, severity and cause									x		
Area, severity and duration of insect disease and damage								x			

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Criterion 2
Incidence of Disturbance and Stress — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Blow down area extent, spatial distribution, frequency and shape								x			
Percent of successful regeneration after harvest to pre-harvest growth track								x			
Cut block size, shape and spatial distribution								x			
Density of roads and landings in cut blocks								x			
Threat minimization									x		
Distribution of cover types and age classes per cover type				x							
Distribution of crown transparency by class				x							
Level of productive forest salvage harvested in insect and disease infected areas							x				
Area and type of human disturbances specific to forest harvesting		x	x								
Level and extent of active pest control operations			x								
Fire detection and suppression success							x				
Levels of wind and other disturbances						x					
Area occupied by exotic species				x							
Presence/relative abundance of exotic, vagrant and expanded range species											x
Average area and distribution of single species softwood plantations				x							

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Criterion 2
Incidence of Disturbance and Stress — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Climate indices: (pH and amount of precipitation)		x									
Percent and extent of forest cover types and maturity classes		x									
Percent of area meeting expected growth targets for site type		x									
Growing stock by forest cover type		x									

Ecosystem Resilience

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Forest stand health					x						
Percentage and extent of area by ecological community type and age class			x								
Changes in landscape composition and pattern									x		
Stand composition and structure									x		
Tree and stand growth rates									x		
Area of barren and scattered and free-to-grow managed forest land						x					
Percent of attempted natural and artificial regeneration which was successful			x						x		
Success rate of natural and artificial regeneration						x					
Harvested area successfully reforested and certified as achieving site renewal objectives at 7 yr Regen survey							x				

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Criterion 2
Ecosystem Resilience — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Percentage of naturally regenerated areas relative to reforested areas				x							
Harvested area successfully reforested and certified as achieving site renewal objectives at 14 year FTG survey							x				
Percent of depleted area successfully regenerated						x					
Fish growth rates									x		
Species interrelationship	x										

Extant Biomass

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Mean annual increment and current annual increment by forest type and age class			x				x				
Forest biomass				x							
Area converted to/from forest land use						x					
Quantity of forest products harvested by species and product						x					
Carrying capacity for economically important species						x					
Allowable harvest level for economically important wildlife species						x					
Planned & actual depletions by forest unit						x					
Silvicultural spending per year in the LAMF						x					

CRITERION 3.CONSERVATION OF SOIL AND WATER RESOURCES

Physical Environmental Factors

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Ground disturbance as a result of logging operations	x										
Percent of forest managed primarily for soil & water protection						x					
Loss of gross productive forest land base							x				
Changes in soil pools of available nutrients in recently harvested areas			x			x					
Chemical and physical structure of soil (pre-and post-harvesting) on representative ecosites			x			x					
Physical soil properties									x		
Foliar nutrients											x
Soil properties											x
Rates of decomposition											x
Soil nutrient status									x		
Percentage of harvested area having significant soil compaction, displacement, erosion, puddling, loss or organic matter, etc							x				x
Soil erosion and land form degradation									x		
Buffering capacity and soil acidification					x						
Distribution and abundance of aquatic fauna						x					
Proportion of catchment disturbed per decade by type of disturbance						x					

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Criterion 3
Physical Environmental Factors — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Water quality as measured by chemistry, turbidity, etc.						x			x		
Number & significance of infractions related to riparian buffer zones						x					
Changes in Land Use Patterns, by individual watersheds, that have an impact on water quality.			x								
Adherence to Canadian water quality guidelines (aquatic, drinking, recreation, agriculture, and industry)			x								
Water yield and regimen									x		
Air and water temperatures are within the range of historic variation											x
Water depth and turbidity is within the historic range of variation											x
Dissolved oxygen levels and water chemistry are within the historic range of variation											x
Rates of marine to terrestrial nutrient transfer											x
Drinking water quality	x										
Water quality	x										
Status of Riparian Zones within the Forest across the landscape			x								
Percentage of riparian areas with natural vegetation cover					x						

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Criterion 3
Physical Environmental Factors — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Proportion of watershed recently (less than 10 yrs. since disturbance) burned or harvested								x			
Percent of harvested area and areas which have undergone post-harvest treatments having significant soil compaction, displacement (rutting & clumping), erosion and/or puddling								x			
Watercourse structure									x		
In stream morphology of stream channels is maintained											x
In stream function of stream channels is maintained											x
Forest management activities, not set out in the management plan, in sensitive areas				x							
% ECA by period for each watershed										x	
Trend and timing of events and seasonal streamflow are within historic range of variation											x
Event and seasonal rainfall are within historic range of variation											x
Ground water levels are within historic range of variation											x
Exposure of ground surface adjacent to water bodies which could result in impairment of water quality							x				
Percent of gross productive forest area in recently disturbed condition (within 7 years of harvest and/or fire) (i.e. harvested and/or burned)							x				

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Criterion 3
Physical Environmental Factors — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Areas significantly disturbed as a result of increases / decreases in water levels							x				
Retention of soil nutrient sources on site in the form of tree limbs and tops left from logging activity							x				
Percentage of potentially erodible sites treated according to SFPOP guidelines							x				
Harvested areas successfully reforested and certified as achieving site renewal objectives at 7 year regeneration survey							x				
Extent of eel grass beds											x
Beach security/patterns and security of drift logs											x
Sedimentation around river mouths											x
Increased fine sediment in water columns											x
Aerial distribution (canopy cover) and density of near shore marine vegetation											x
Intertidal community structure and diversity is within range of natural variation											x
Health and reproductive success of near shore marine vegetation											x
Recovery of sub-tidal exploited species											x
Extent of harvest area with significant soil disturbance		x									
Percentage of watershed area in a recent cut condition		x									

Policy and Protection Factors

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Percent of forest managed primarily for soil and water protection							x				
Number of failures displaced per unit time between developed and undeveloped areas											x
Number of failures reaching mainstream											x
Volume of soil displaced per unit time between developed and undeveloped areas											x
Amount of land deliberately owned from 'production'											x
Degree of Implementation of Guidelines for Soil and Water Protection (eg: Clean Water Act, guidelines for Crown Land, BMP's, Pesticides/Petroleum) use of machinery adjacent to water/buffers/ guidelines for soil, BMP's for rutting			x								
Implementation of Guidelines for Forest Class Road and Crossing Construction and Maintenance			x								
Forest policy	x										
Distribution of crown transparency classes in watersheds				x							
Surface area of wetlands, including bodies of water, within forested areas				x							
Unscheduled activity in managing the immediate environment of perennial and intermittent streams				x							
Provincial and federal procedures, approvals, permits and licenses							x				

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Criterion 3
Policy and Protection Factors — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Disciplinary actions							x				
Percentage of forest managed under BMPs and other guidelines		x									
Percentage of riparian zones meeting specifications		x									
Percentage of stream crossings constructed and maintained to standard		x									
Number of reportable spills							x				
Ratio of surface water to land surface							x				
Area significantly disturbed as a result of increase/decrease in water level							x				
Area of forested and non-forested land							x				
Current annual growth of productive forest							x				
Production of recycled pulp from de-inking plant							x				
Level of fuel usage							x				
Area of forested and non-forested land on FML 01 converted to permanent roads							x				
Area of forested land							x				

CRITERION 4: FOREST ECOSYSTEM CONTRIBUTIONS TO GLOBAL ECOLOGICAL CYCLES

Contributions to Global Carbon Budget

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Net primary productivity						x					
Tree and non-tree biomass						x					
Net carbon flux						x					
Mean Annual Increment by forest type and age class						x					
Tree biomass volumes			x								
Vegetation (non-tree) biomass estimates			x								
Percentage of canopy cover			x								
Percentage of biomass volume by general forest type			x								
Soil carbon pools			x								
Soil carbon pools and decay rates			x								

Forest Land Conversion

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Area converted to/from forest land use			x								
Reduction of land base available for timber production								x			
Semi-permanent or temporary loss or gain of forest ecosystem, e.g., grasslands and agriculture			x								
Forest biomass				x							

Forest Sector CO^2 Conservation

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
None											

Forest Sector Policy Factors

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Existence of Forest Inventories			x								
Existence of laws and regulations on forest land management			x								

Contributions to Hydrological Cycles

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Surface area of water within the forest area			x								
Surface area of wetlands, including bodies of water, within forested area				x							
Ground level ozone and pollution deposition					x						
Climate trends					x						

CRITERION 5: MULTIPLE BENEFITS TO SOCIETY

Productive Capacity

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Timber usage	x										
Quantity of forest products harvested by species and product										x	
Annual removal of forest products		x									
Total growing stock										x	
Annual removal of timber relative to volumes deemed sustainable			x				x				
Availability of habitat for selected wildlife species of economic importance			x								
Sustainable wildlife habitat units							x				
Landbase available for production of forest products		x									
Volume of merchantable wood left on site after harvest		x									
Crown forest area available for timber production						x				x	
Annual sampling relative to forest production capacity per species category				x							
Distribution of age class				x							
Annual volume of forest by-products and waste		x									
Average annual area harvested										x	
Volume of standing timber to which appropriate road access has been developed							x				

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Criterion 5
Productive Capacity — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Changes in land use and /or ownership patterns that affect the area available for timber production			x								
Merchantable volume per species category				x							
Percentage of stand tending relative to all silvicultural practices				x							
Distribution of cover types and age classes per cover type				x							

Competitiveness of Resource Industries

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Trends in forest products and processes within the forest			x								
Return on capital employed							x				
Capital investment on a long term basis							x				
Ranking with respect to cost of delivered wood							x				
Competitive cost position									x		
Issues identified and dealt with							x				
Consultations with potentially affected forest-based industries							x				
Contributions to Gross Provincial Product by specific timber and non-timber sectors		x									
Employment in specific timber and non-timber sectors		x									

Contribution to the Economy

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Employment in the forest industries	x										
Outfitting revenue	x										
Production of timber forest products					x						
Capital expenditures in forest resource based businesses by sector						x					
Stumpage rates and amount by species by product						x					
Regional wood prices					x						
Value of timber and manufactured products from the forest, by product						x					
Economic value of consumptive goods and recreational activities provided by the forest (excluding timber)						x					
Non-consumptive forest based recreational and tourism opportunities and use, by type of use & number of users						x					
Trends in income and employment from timber and non-timber sources			x								
Employment in forest-related sectors					x				x		
Number of local jobs in forestry											x
Number of people employed in the forest industry								x			
Population age structure				x							
Average age of new employees entering the forestry sector				x							

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Criterion 5
Contribution to the Economy — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Average income of tree farmers				x							
Average earnings of tree farmers				x							
Tree farm hiring				x							
Permanent and seasonal jobs (employment insurance) in the forestry sector relative to total jobs				x							
Value of subcontracting				x							
Number and value of contracts awarded to enterprises in the area							x				
Offers of economic opportunity to FML communities							x				
Expenditures or payments of the Company to residents, businesses and governments							x				
Mechanisms for sharing the economic benefits derived from forest management											x
Wages and other benefits conform to national and/or ILO standards											x
Incomes in forest-based communities by sector									x		
Education									x		
Real estate values									x		
Social pathologies									x		
Usage of forest access roads	x										
Use of forests for non-market goods and services		x									

Non-Timber Values

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
What is the potential work force								x			
Number of people employed in non-forest based activities								x			
Volume marketed per product category relative to forest capacity				x							
Area harvested in Back country recreation zones										x	
Area harvested in Front country recreation zones										x	
Road management plan in place							x				
Area and percentage of forest managed for other values by degree of protection			x								
Availability, potential, and use of non-timber benefits.			x								
Include identified special use areas and areas of concern into planning processes as they are brought forward during joint planning with First Nations and other public consultation processes							x				
Percentage denuded by VQO polygon by period										x	
Degree of achievement of maple growing potential				x							
Total expenditures by individuals related to non-timber use						x					
Forest management activities, not set out in the management plan, in the immediate environment of perennial and intermittent streams				x							

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Criterion 5
Non-Timber Values — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Forest management activities, not set out in the management plan, in winter moose and deer yards				x							
Forest management activities, not set out in the management plan, in the immediate vicinity of sectors of interest				x							
Quantity and quality of beach debris											x
Soil compaction and degradation											x
Implementation of scenic resources, recreation and tourism values inventory system with characteristics ascribed by the CSSP											x
Develop and review scenic resources, recreation and tourism values resource mgmt plan											x
Extent of forest plans that incorporate tourism and recreation values and visual landscape mgmt plan recommendations											x
Examples of different types of landscapes are retained relatively unaltered states											x
Recreational planning integrates needs of tourists and residents											x
Availability of recreation opportunities are maintained											x
Area and number of special forest places		x									
Landscape visual aesthetic appeal		x									

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Criterion 5
Non-Timber Values — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Density/Quality/Diversity of interpretative trails		x									
Quantity of litter/garbage collected.		x									
Satisfaction levels of users with forest recreation opportunities		x									
Number of jobs resulting from on-going operation of PFPC							x				
Population						x					
Labour force						x					
Average household income						x					
Composition of income						x					
Incidence of low income						x					
Education						x					
Percent of economic base in forestry						x					
Labor force by industry						x					
Value Added						x					
Domestic use of products from the forest	x										
Economic value of intangible goods and services						x					
Maintenance of community social values											x

CRITERION 6: ACCEPTING SOCIETY'S RESPONSIBILITY FOR SUSTAINABLE DEVELOPMENT

Aboriginal and Treaty Rights

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Meet provincial and federal legislation requirements							x				x
PFPC staff participating in awareness workshops							x				

Participation by Aboriginal Communities in SFM

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Number and percent of Aboriginal communities in or adjacent to the management unit involved in the Forest Management Native Consultation Process						x					
Extent of Aboriginal participation in forest-based economic opportunities						x					x
Extent to which forest management planning takes into account the protection of Aboriginal social, cultural, or spiritual sites			x			x					
Extent of Aboriginal satisfaction with forest based economic opportunities						x					
Assessing the level of understanding that all parties involved in the forest management planning operations have of Aboriginal issues			x								
Number of Aboriginal communities with a significant forestry component in the economic base and diversity of forest use at the community level											x
Extent of compliance with federal government guidelines for employment equity											x

Criterion 6
Participation by Aboriginal Communities in SFM — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Extent to which firms operating in the Sound actively recruit First Nations in employment equity											x
Extent of Nuu-chah-nulth participation in monitoring											x
Area of Sound available for subsistence purposes											x
Area of Sound available for continued cultural use											x
Area of Sound available for continued resource use											x
People maintain spiritual links with the land											x
Extent of incorporation of Nuu-chah-nulth knowledge in cultural inventories											x
Forest activities meet international standards regarding indigenous peoples											x
Co-management of the Sound is based on equal partnerships between Nuu-chah-nulth and the Province of BC											x
A working protocol for ecosystem co-management, based on mutual respect, is designed and maintained											x
Extent or proportion of forest practices that incorporate TEK and hahuulhi											x
Extent to which Nuu-chah-nulth are given opportunity to identify, locate and evaluate culturally important sites and areas prior to completion of planning processes											x

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Criterion 6

Participation by Aboriginal Communities in SFM — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Planning inventories are conducted in full consultation with Nuu-chah-nulth											x
All forest operations are conducted in full consultation with Nuu-chah-nulth											x
Training and education programs on ecosystem management processes and practices are made available to the Nuu-chah-nulth											x
Extent to which forest and ecosystem workers and managers view educational videos or receive other orientations produced by Nuu-chah-nulth people about their perspectives on forest practices, impacts on the environment and their culture											x
Extent of monitoring programs for the Sound undertaken in full consultation and with participation of Nuu-chah-nulth											x
Extent to which environmental and social impact assessment procedures are used to value present and ongoing forest activities											x
Nuu-chah-nulth sacred sites conserved or restored											x
Extent to which damage to ecosystems, culturally important areas, and traditional resources occur, mitigative action is undertaken											x
Archeological and historic sites, including those defined by oral traditions are conserved or restored											x
Damages are compensated in a fair manner											x

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Criterion 6

Participation by Aboriginal Communities in SFM — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Extent to which restoration activities to damaged ecosystem are undertaken in full consultation and with participation of Nuu-chah-nulth											x
Degree of involvement of Mi'kmaq and/ or Aboriginal people in SFM process		x									
Level of understanding of all parties involved in SFM of Mi'kmaq issues		x									
Percent of households with forest based employment full or part time		x									
Number of communities (households) with a significant forestry component to their economic base		x									
"Index of diversity" of local industrial base with significant forest economic base		x									

Sustainability of Forest Communities

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Extent of public involvement in forestry issues	x										
Level of satisfaction with how forestry concerns have been addressed	x										
Number of communities with stewardship or co-management responsibilities			x								x
Community involvement in sustainable forest management					x						
Profitability of PFPC operation leading to sustainable employment levels							x				

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Criterion 6
Sustainability of Forest Communities — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Value of forest management contracts awarded to all local enterprises							x				
Consultations with local community business organizations, individual enterprises and local elected officials regarding PFPC activities							x				
The establishment of community development strategies where PFPC would participate in joint planning							x				
Degree of public participation in SFM process		x									
Investments in forest related research and technology transfer		x									
Percentage of forest area under SFM plans		x									
Degree of public is knowledgeable of SFM		x									

Fair and Effective Decision Making

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Sources of information on forestry issues	x										
Awareness about the WNMF	x										
Degree of public participation in decision-making process			x			x					
Local Citizen's Committee evaluation of its effectiveness						x					

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Criterion 6
Fair and Effective Decision Making — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Degree of implementation of local planning process and BMP's by landowners and managers			x								
Stakeholder involvement in forest decision-making									x		x
Private land management and conservation practices					x						
Annual consultation with the public and tenant farmers				x							
Ongoing community consultations							x				
Financial participation in management and sustainable development				x							
Variety and participation levels in forums for public involvement							x				
Issues identified and dealt with at the community level							x				
Consultation early in the planning process							x				
Management staff and stakeholders recognize and respect the interests and rights of each other											x
The decision-making processes must be transparent such that participants are confident that their opinions and values will be considered in the process and reflected in the final products											x
Effective instruments for inter-institutional co-ordination on land use and forest management exist											x

Informed Decision Making

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Quality of existing forest inventory						x					
Percentage of area covered by multi-attribute resource inventories			x								
Investments in forest-based R&D and information				x		x					
Effectiveness of public education			x								
Level of technology transfer activities in the MF			x								
Percentage of forest area under management plans which has included local and meaningful participation that represents the concerns of the local area			x								
Existence of an inventory outlining the most effective conservation practices relating to the public use of forest products			x								
Degree of implementation of most effective conservation practices relating to the use of forest products			x								
Level of understanding and awareness of sustainable forest management	x			x					x		
Contribution to workforce training and public education in sustainable development				x							
Mutual learning mechanisms					x						
Participation in forest education and awareness programs					x						
Continual improvement									x		

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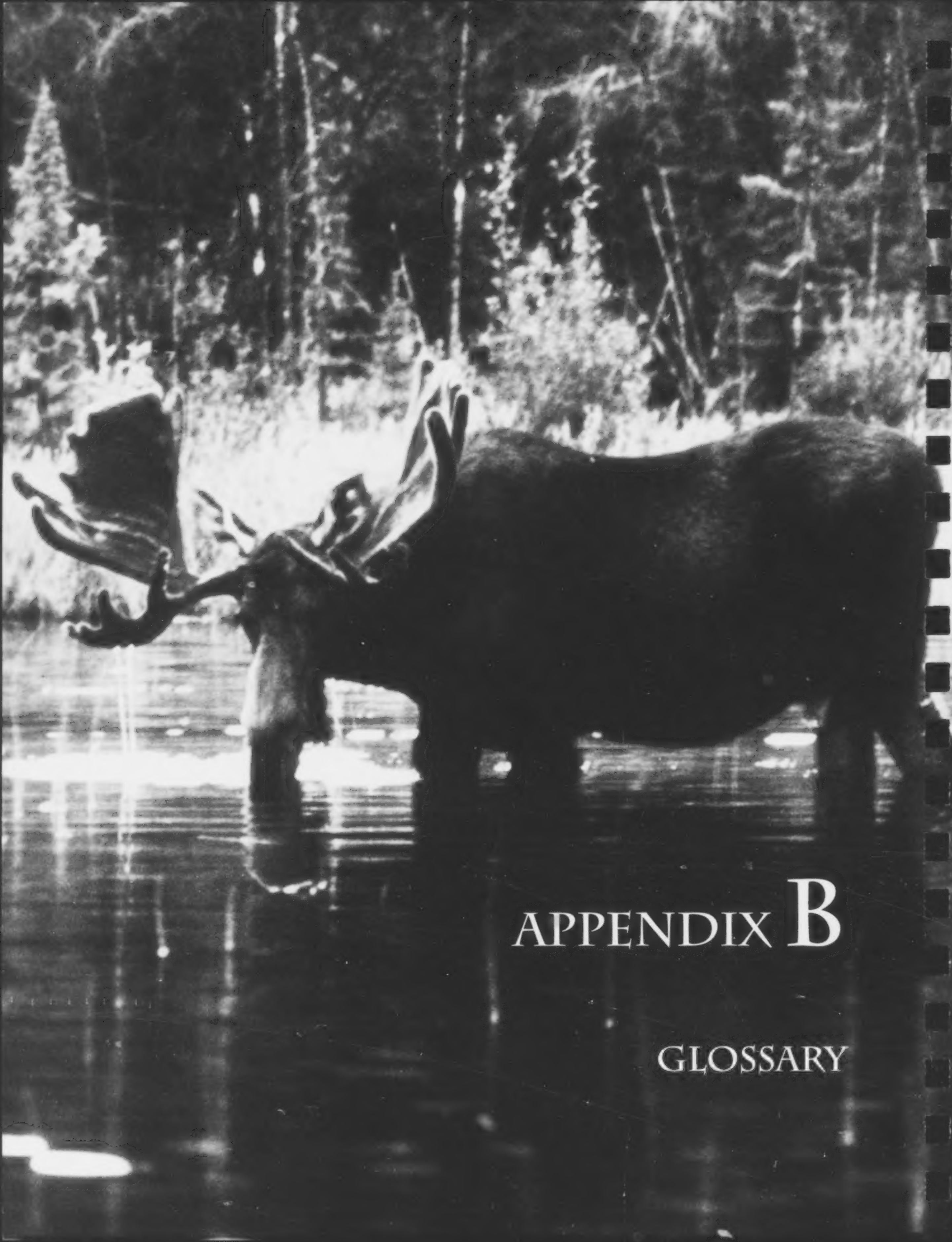
Criterion 6
Fair and Effective Decision Making — continued

Indicator	WNMF	NFA	FMF	BSLMF	EOMF	LAMF	MbMF	PAMF	FtMF	McMF	LBMF
Research partnerships and projects undertaken by PFPC with government and others							x				
Participation in and creation of public information on forests							x				
Communities that have provided TEK to the SFM process while respecting the proprietary nature of TEK							x				
Available and timely forest information on which to plan and operate and assess achievement of targets							x				
A monitoring program for FML 01 that covers established Indicators and targets							x				
Opportunities to meet and discuss SFM							x				
Training and on-going forest education, related to implementation of SFPOPs							x				
Stakeholders have detailed and meaningful reciprocal background information nec-essary to provide quality input into public participation processes											x
Sustained and adequate funding for ecosystem management											x
Planning and management are based on recent and accurate information											x
Changes in efficiencies associated with modified forest practices											x



APPENDIX B

GLOSSARY

A

Abiotic: The non-living components of the environment (e.g., precipitation, temperature, ice, and windstorms).

Aboriginal: As defined by the Constitution Act, Section 35(2), II Aboriginal peoples of Canada" includes the "Indian, Inuit, and Metis" peoples of Canada. See First Nation and Indigenous Community.

Accountability: Decision-makers at every level taking responsibility for their decisions.

Acid Precipitation: Precipitation with a pH lower than about 5.0, the normal pH that water droplets have due to dissolved carbon dioxide, sulfates, and nitrogen oxides picked up from the atmosphere. Increased acidity results from anthropogenic emissions (e.g., burning of fossil/ fuels), or from natural causes (e.g., gases emitted from volcanoes). Its effect on ecosystems is complex, depending on the form of precipitation and the buffering capacity of the soils.

Acid Rain: see Acid Precipitation.

Advanced Regeneration: The regeneration of seedlings under a forest canopy such that if a gap is produced in that canopy, the seedlings may quickly fill that gap.

Age Class: A classification of tree stand ages within a forest into a series of age ranges usually beginning from the last major disturbance.

Alien Organisms: see Exotic Species.

Alpha Diversity: The diversity of life forms observed within a relatively homogeneous environment. Compare Beta Diversity and Gamma Diversity.

Amplitude: The degree of severity of an event. Compare Frequency.

Annual Allowable Cut (AAC): The amount of timber that is permitted to be cut annually from a particular area. AAC is used as the basis for regulating harvest levels to ensure a steady flow of timber.

Anthropogenic: Resulting directly from human activity.

Aspect: The direction that a slope faces (e.g., north-facing vs. south-facing). Plant communities existing on similar slopes but different aspects may be vastly different from one another, due to differences in light conditions, temperatures, and precipitation.

Association: A group of associated species which form a community with floristic and physiognomic unity. Usually a climax community with distinct dominant and co-dominant species.

B

Basal Area: The area of the forest floor occupied by tree stems.

Benchmark: A standard point of reference. A sample site used for approximating changes in similar sites or areas caused by a number of factors including pollutants, disturbance, fire suppression, and others. See Biological Reference Point.

Beta Diversity: The rate of change in species composition across the landscape. The ratio of gamma diversity to alpha diversity.

Biodiversity: The variability of life on Earth, including genetic, species, population, community, and ecosystem diversity.

Biological Control: The control of an organism's abundance by another organism through predation, herbivory, parasitism, or other means. A pesticide-free means of controlling unwanted pests or weeds.

Biological Diversity: See Biodiversity.

Biological Reference Point: A reference point used to determine the status of a biological population, community, or ecosystem.

Biomass: The total dry mass of all living and dead organisms within an area at a given moment.

Biosphere: Areas of the planet where life is found, including on or below ground and water, and in the lower atmosphere. Effectively a whole-planet ecosystem.

Biota: All of the living organisms in a given area ecosystem, including bacteria and other micro-organisms, plants and animals.

Birth Rate: The number of individuals of a population born within a given time period.

Bog: An acidic and wet peatland area characterized by low nutrient levels and slow decomposition rates: Bogs tend to be dominated by ombrotrophic peat mosses, sedges, ericaceous shrubs, and stunted evergreen trees.

Buffer Zone: Areas of undisturbed land adjacent to roads, trails, waterways, and recreation sites. Their purpose is to preserve aesthetic and other qualities.

Buffering Capacity: The ability for a material to absorb acids or bases without having a significant increase or decrease in that material's pH.

C

Canopy: The cover of leaves from the upper portion of a tree. A dense canopy will limit the amount of direct light reaching the under story. See Crown Transparency.

Carbon Budget: A model tracking and accounting for changes in the abundance and distribution of carbon throughout the Earth's atmosphere, biosphere, and geosphere.

Carbon Cycle: The cycling of carbon through the atmosphere, surface, and interior of the Earth, from an inorganic to organic state by processes of photosynthesis (see primary production) and eventual respiration or combustion.

Carbon Pool: The storage of carbon within a carbon sink. Carbon may be stored as parts of living organisms (e.g., wood from living trees) or as dead organic material (e.g., fallen trees, peat, organic soils, and fossil fuels).

Carbon Sink: An area where the rate of carbon uptake through photosynthesis exceeds the rate of carbon loss through combustion and respiration, such that the amount of carbon within the sink increases over time. See Carbon Pool

Carbon Storage: See Carbon Pool.

Carrying Capacity: The maximum amount of life an area can sustain.

Climate Change: A shift in long-term averages of measurable climatic variables (e.g., precipitation, temperature, frequency of storms, etc.). May be a naturally-occurring phenomenon (e.g., glaciation) or an anthropogenic one (e.g., greenhouse effect). Leads to changes in species distributions, ecosystem structures, and corresponding socio-economic activities.

Climax Community: A self-perpetuating community in the final stage of succession where the abundance of existing species is in equilibrium with the environment. Although changes may occur in a climax community, they do so at a very slow rate relative to changes occurring at lower stages of succession.

Cohort: A group of individuals of the same age recruited into a population at the same time. Similar to an age class.

Co-management: Forms of shared natural resource management between local representatives and provincial governments, with local participants having a varying degree of decision-making power, from advisory to shared jurisdiction.

Combustion: The abiotic energy-yielding process of converting organic carbon into inorganic forms, usually done by burning. Combustion can be a naturally occurring (e.g., lightning-induced forest fires), or anthropogenic (e.g., burning of fossil fuels).

Communication: The open and wilful exchange of information and ideas between individuals or parties.

Community: An assemblage of plants, animals (including humans), and other organisms that live and interact with each other within a particular environment, ultimately depending upon each other for existence.

Community Respiration: The amount of respiration occurring within a community over a defined period of time by all of its organisms.

Community Structure: The structure given a community through the interactions (e.g., predation, competition, mutualism, succession, etc.) that occur between the species that comprise it. Often measured in terms of the abundance and distribution of species within the community and the rate of changes in abundance and distribution.

Compaction: see Soil Compaction.

Connectedness: The degree to which individuals of a species may move from one habitat to another. See Fragmentation .

Conservation: The maintenance of environmental quality, diversity, and resources through the management of human activities. Resources include biotic, abiotic, and cultural resources. Conservation methods include preservation, maintenance, sustainable use, restoration, and enhancement of populations and habitats.

Constancy: The degree of predictable fluctuation in species compositions and abundances within a given area over a period of time.

Continual Improvement: The ongoing process of enhancing sustainable forest management performance, resulting from experience and the incorporation of new knowledge.

Corridors: Small reserves of natural habitat that link larger reserves so that species can move from one area to another.

Criterion (plural: Criteria): Distinguishable characteristics of sustainable forest management.

Crown Transparency: The degree to which light passes through the leafy portion of a tree canopy. Often used as a measure of forest health.

Cumulative Effects: The effects on the environment resulting from individually minor but collectively significant actions taking place over a period of time.

D

Dead Organic Material: The organic materials, mostly made up of carbon, accumulated from dead organisms or parts of organisms (e.g., leaves, carcasses, etc.).

Decomposition: The breakdown or decay of organic material by bacteria, fungi, and invertebrate organisms (e.g., flies, worms, and nematodes).

Detritus: See Dead Organic Material.

Dieback: See Forest Stress Syndrome.

Dispersal: The tendency of an organism to move away from its place of origin, breeding site, or the site of its parents. Can be thought of on a broader scale as the outward extension of a species range.

Dissolved Oxygen Content: The concentration of oxygen held in solution in water. Usually measured in mg/L or expressed as a percentage of the saturation value for a given water temperature. In general, oxygen levels decline as pollution increases.

Disturbance: The disruption in growth of an individual, population, or community of species due to natural or anthropogenic factors such as herbivory, , forest fires, road building, disease infestation, and tree harvesting.

Disturbance Ecology: The study of the effects of disturbance on the characteristics and dynamics of populations, communities, and ecosystems.

District: A forest management district outlined by the local government.

Diversity: See Biodiversity.

Dry Deposition: Deposition of pollutants from the atmosphere onto ecosystems.

Dynamic Landscape Heterogeneity: Refers to the variability in community types and secessional stages occurring in time over the landscape. In general, heterogeneity is most obvious in mountains or hilly areas where available resources may vary over distances of only a few metres due to changes occurring in slope and aspect.

Dynamic: Refers to the ever changing nature of ecosystems and ecosystem components in time and space.

E

Ecological Land Classification: A type of land classification system which groups geographical areas based on similar relevant ecological criteria as opposed to solely physical or political criteria.

Ecological Management: A management strategy which attempts to mimic natural ecosystem processes such that the diversity of forest species and forest ecosystem processes are maintained indefinitely.

Ecosystem: A discrete, dynamic, and interdependent system formed of interacting individuals and populations of plants, animals, other organisms, and abiotic environmental components. See Individual and Population.

Ecosystem-based Management: A management strategy which considers an entire ecosystem as the basic functional unit to be managed. Under ecosystem-based management, all management techniques and strategies are evaluated based on how they will affect the entire ecosystem.

Ecotype: Genetically distinct populations of the same species, formed due to the populations living under differing environmental conditions. Ecotype show minor changes in morphology and/or physiology, which are related to habitat and are genetically fixed.

Ecozone: Geographical area defined by reference to a range of interacting environmental gradients, reflecting animal as well as plant characteristics. Compare Life Zone.

Edge Effect: Occurs when the transitional zone between two communities provides habitat for a different set of organisms, or provides habitat that can be used by members of both adjacent communities.

Edge Habitat: A loosely defined habitat type that occurs at the boundary between two discrete habitat types, for example at boundary between forest and grassland, or a clear-cut and an undisturbed forest stand. Edge habitats may favour certain species but not others.

Elasticity: See Resilience.

Emergency Response: A system for assessing and dealing with emergencies which, if not dealt with urgently, may have costly repercussions. Types of emergencies include chemical spills, fires, accidents, natural disasters, and others. Agencies mobilized include fire, police, health, and rescue officials, as well as disaster coordinators, military personnel, and other technical specialists.

Emigration: The movement of members away from a population. Compare Immigration.

Endangered Species: A species facing imminent extinction or extirpation.

Endemic Species: A species that is restricted, or whose origins are restricted, to a particular geographic region, owing to factors such as isolation or response to soil or climatic conditions.

Environment: The combination of all external biotic and abiotic factors that influence an organism.

Environmental Citizenship: Acceptance by individuals of their ethical responsibilities toward the environment.

Environmental Impact Assessment: The systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, or legislation relative to the physical, chemical, biological, cultural, and socio-economic components of the environment.

Erosion: The wearing away of landforms by wind, water, or glacial ice.

Evapotranspiration: Loss of water to the atmosphere by evaporation from soil surfaces or transpiration from leaf surfaces.

Evolutionary Potential: The degree to which a species can gradually change its genetic, morphological, and behavioural characteristics to better suit the existing environmental conditions, such that the species can continue to survive and reproduce.

ex situ: An approach to conservation in which components of ecosystems are conserved outside their natural habitats. Compare in situ.

Exotic Species: Any species that is introduced into an ecosystem that is outside its normal range, by anthropogenic means.

Extant: A species that currently exists on Earth. See Extinct.

Extinct: A species that no longer occurs anywhere on Earth. See Extant.

Extinction Vortex: As the number of individuals of a population drops below the minimum viable population, it is said to fall into an extinction vortex, or certain extinction unless extraordinary countermeasures are taken.

Extirpated: Extinction caused by direct human action, such as hunting, trapping, etc.

F

Fauna: Animals

Fen: An alkaline and wet peat/and area, characterized by high nutrient levels. Fens tend to be dominated by minerotrophic grasses and peat mosses. Compare Bog.

Fecundity: The fruitfulness of flora or fauna in producing offspring.

Field Capacity: Water that remains in soil after excess moisture has drained freely from that soil. Measured as the percentage of the mass or volume of oven-dried soil.

Fire Frequency: The number of times a fire passes through a defined area, over a period of time.

Fire Intensity: The severity of a fire as it passes through a defined area.

Fire Suppression: To extinguish or otherwise not allow fires to occur within an area.

First Nations: The peoples who have lived within North America prior to colonization by Western Europeans, and their descendants. Includes all Indian, Inuit, and Metis peoples. First Nations is derived from the belief that these peoples were the original human inhabitants of North America. See Aboriginal.

Flora: Plants

Floristic: See Flora.

Food Web: See Trophic Web.

Forest: A plant community or predominantly trees and other woody vegetation growing more or less closely together, its related flora and fauna, and the values attributed to it.

Forest Land: Land supporting forest growth or capable of so doing, or, if totally lacking forest growth, bearing evidence of former forest growth and not now in other use.

Forest Management: The practice of controlling the composition, structure, and dynamics within forest ecosystems, via practices such as fire-suppression, controlled burning, timber harvesting, pest control, and others, such that a desirable outcome (such as maximal wood production) is obtained.

Forest Stress Syndrome: The loss of foliage and branches from dominant woody plants beginning from the terminal portions of the plants. A syndrome that is occurring in various forests throughout the world. Thought to be triggered by pollutants, although other factors such as climate and natural biological rhythms may be implicated.

Forest Type: A classification of forests largely based on global or local changes in temperature and precipitation. In the broadest sense, the three main forest types are tropical, temperate, and boreal forests. However, within these three types, forests may be further separated into montane forests, savannas, moist coniferous forests, temperate broad-leaved forests, and many others.

Forestry-dependent community: A community that is dependent on the commercial timber sector for its survival. According to classifications used by statistics Canada, a community is moderately forestry-dependent when it relies on the timber sector for 10-50% of its economic base employment, and heavily forestry-dependent if it relies on the timber sector for more than 50% of its economic base employment.

Fossil Fuel: Underground stored organic carbon, produced from fossilized plants and tiny animals that lived millions of years ago. Occurs in forms known as oil, gas, coal, and other fuels. See Combustion.

Fragmentation: The breakdown of once continuous habitats, ecosystems, or landscapes into discontinuous units. May result from human or natural disturbances. See Connectedness.

Freehold Land: Privately owned land, with timber, surface and water rights, as well as some mineral rights.

Frequency: The number of times an event occurs within a larger period of time.

Fugitive Species: A species typical of disturbed or otherwise unstable environments. Characterized by high dispersal rates, short life cycles, and poor long-term survival ability under competition.

G

Gamma Diversity: The diversity of life forms observed within a relatively large area usually encompassing many different environments. Compare Alpha Diversity and Beta Diversity.

Gap Analysis: The identification of critical habitats within a region that are unprotected, usually using computer-based Geographic Information Systems.

Gene Pool: The total number of genes or the amount of genetic information possessed by all the reproductive members of a population of sexually reproducing organisms.

Genetic Depression: The increase in genetic load within a population caused by decreased genetic variability and increased inbreeding.

Genetic Drift: The random fluctuations in gene frequencies within a population such that the genetic make-up of the offspring is not perfectly representative of the parental genetic make-up.

Genetic Load: The average number of lethal mutations per individual in a population. Genetic load increases with inbreeding and as the genetic variability within a population is reduced. See Genetic Depression.

Genetic Resources: The gene pool in natural and cultivated stocks of organisms that are available for human exploitation. It is desirable to maintain as diverse a range of organisms as possible such that there is a greater capacity for adaptation to particular environmental conditions.

Geographic Information Systems: A computer-based information system that uses a spatial database to provide answers to questions of a geographic nature. Information is retrieved via manipulations such as layering, sorting, selective retrieval, calculation, spatial analysis, and modelling.

Geosystems: Soil and water processes as affected by natural or anthropogenic processes such as fire, erosion, deposition, mineral extraction, agriculture, etc.

Germ Plasm: Hereditary genetic material.

Global Markets: The buying and selling of raw or processed goods and/or services among businesses and corporations based within different countries or continents.

Goal: A broad, general statement that describes a desired state or condition related to one or more forest values.

Gravitation: Downward movement of soil moisture under the influence of gravity.

Greenhouse Effect: The retention of heat energy from the sun by trace gases (i.e., greenhouse gases) in the atmosphere. Energy passes through the atmosphere as shortwave radiation, then reflects off the Earth's surface as long-wave radiation which is absorbed by greenhouse gases. The greenhouse effect is what maintains the atmospheric temperature balance of the Earth.

Greenhouse Gases: Trace gases which, when present in the atmosphere, contribute to the greenhouse effect. The principal greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, halocarbons, and ozone.

Gross Domestic Product: The amount paid to Canadians, including governments, in the form of salaries, wages, profits, taxes, and royalties. GDP is used as a measure of national income, and as such is a quantitative measure, not a qualitative one.

Ground-Level Ozone: Ozone that occurs at ground level as a result of industrial pollution. The major component of smog. Also known as tropospheric ozone. See Ozone.

Guild: A group of species having similar ecological resource requirements and foraging strategies, and therefore having similar roles in the community. Also used to describe a group of species that are mutually interdependent.

H

Habitat: The environment, including biotic and abiotic components, that a plant or animal population requires in order to live and complete its entire life-cycle, or elements of it.

Hardwood(s): Refers to the trees of the division Angiospermae, characterized by broad leaves, a deciduous habit, and seeds that are enclosed fully by fruits. Also refers to the wood of those trees. Compare Softwoods.

Heat Balance: The average temperature of the Earth. For a given level of incident solar radiation (i.e. heat), the average temperature of the Earth depends upon the amounts and types of greenhouse gases in the atmosphere, and the degree to which heat is absorbed or reflected by its abiotic and biotic surfaces.

Historic Variation: The variation in abiotic or biotic components of the environment that occurred naturally prior to the anthropogenic effects of humans since European colonization.

Horizontal Transport: Energy and matter allocation among species that potentially use the same resources.

Humus: A brown or black complex material resulting from the partial decomposition of dead organic matter and forming the organic portion of the soil.

Hydrologic Cycle: The cycling of water through the atmosphere, terrestrial and aquatic ecosystems, and the interior of the Earth.

Hygroscopic Water: Water retained in soil within pores less than 0.1 micrometers in diameter, as well as water absorbed in thin films on soil particles. Hygroscopic water is held so tightly in the soil that it is generally not available to plants. See Capillary Water, Gravitation, and Field Capacity.

I

Immigration: The movement of members into a population. Compare Emigration.

Inbreeding: The breeding of a pair of plants or animals of the same species that are closely related genetically. Compare Outbreeding.

Indicator: A quantitative or qualitative measure that is capable of showing the status and/or direction of change.

Indicator Species: A species that when monitored can provide useful information regarding the status and/or direction of change of the ecosystem in which it occurs.

Indigenous Community: A community of Aboriginal people(s) that has depended upon local ecosystems for their spiritual and material needs for thousands of years, and as such are inherent components of those ecosystems. See Aboriginal and First Nation.

Individual: A single discrete organism of a particular species. See Population and Ecosystem.

in situ: An approach to conservation in which components of ecosystems are conserved within their natural habitats. Compare ex situ.

Integrated Resource Management: A forest management planning process that addresses all aspects of resource management and takes into consideration a wide array of timber and non-timber forest values; based on a management philosophy of shared decision-making, a high degree of coordination and cooperation and a recognized legitimacy of other interests, with the ultimate aim of resolving any anticipated conflict.

Interspecific Competition: Competition for scarce resources occurring between individuals of different species. This important ecological process is often considered to be a driving force behind competitive exclusion, niche differentiation, succession, and other ecosystem phenomena. Compare Intraspecific Competition.

Intraspecific Competition: Competition for scarce resources occurring amongst individuals of the same species. Compare Interspecific Competition.

Intrinsic Value: A value that belongs to the essential nature of something, and is independent of any particular benefit to humans.

Invasive Species: A species that is capable of invading and dominating an area, usually after a localized or landscape-level disturbance. Usually an exotic species.

Introduced Species: A species that is established within an area by anthropogenic means.

Island Biogeography: The theory that the number of species inhabiting an island (i.e., species diversity) is a function of island area and distance from the mainland, and is determined by the relationship between immigration, which is greater on larger or nearer islands, and extinction, which is greater on smaller islands. This theory can also be applied to 'islands' of natural habitat, such as parks, that are surrounded by highly modified human landscapes. See Island Effect.

Island Effect: When a population, community or ecosystem is geographically isolated from other populations, communities or ecosystems, by natural or anthropogenic causes. The ecological dynamics (e.g., diversity, stability and resilience) of such areas are similar to those of true islands. See Island Biogeography, Connectedness, and Fragmentation.

K

Keystone Species: Any species that are deemed to play some unique and critical role in ecosystem structure or function. Accorded to a species when by feeding or other activities it significantly alters the structure of trophic levels below it, or when it provides unique food or habitat for other members of the community. Compare Redundancy.

L

Landscape: A mosaic of community types within a region reflecting differences in local levels of available water and nutrients, gradients in atmospheric carbon dioxide, and varying temperatures. See Dynamic Landscape Heterogeneity.

Landscape Ecology: The study of patterns in local ecosystems within a given area and the interactions among different local ecosystems.

Leaf Area Index: The total leaf surface area of a plant exposed to incoming light, per unit ground surface area under that plant.

Licensed Land: Ownership for a specific period of time of the standing timber and the rights to harvest that timber.

Light Penetration: The degree to which light penetrates through the foliage of terrestrial plants or through a column of water.

Limiting Resources: Any resource that approaches most nearly the limits (maximum or minimum) of tolerance for a given organism.

Litter: The uppermost slightly decayed layer of organic matter on the forest floor.

Local: Of or relating to communities of people defined by the boundaries of some form of local government.

M

Macro nutrients: Nutrients required in relatively large quantities for optimal growth. Compare Micronutrients.

Marsh: An ecosystem with more or less continually waterlogged soil dominated by immersed herbaceous plants but without a surface accumulation of peat.

Maturity Classification: See Age Class.

Mean Annual Increment: Average net annual increase in yield of living trees of a given area. expressed in terms of volume of wood per unit area. A measure of the net production of woody biomass.

Micronutrients: Nutrients required in minute quantities for optimal growth. Compare Macro nutrients.

Mineral Cycle: See Nutrient Cycle.

Mineralization: The conversion of organic tissues to an inorganic state as a result of decomposition by soil microorganisms.

Minimum Population Size: See Minimum Viable Population.

Minimum Viable Population: The minimum number of individuals required to maintain population viability. Below this threshold, short-term genetic depression and longer-ten loss of genetic variability through genetic drift threaten the survival of the population. See Extinction Vortex.

Modified Suppression: When a forest fire or other wildfire is purposely not fully suppressed by fire wardens. Normally employed in areas of low economic value.

Monitoring: The daily, seasonal, annual or longer-term collection and analysis of environmental or social data.

Monoculture: The production of a crop which consists of a single species.

Morbidity: The proportion of individuals in a population suffering from a particular disease, expressed as a percentage or fraction.

Mortality: Death rate as a proportion of the population, expressed as a percentage or a fraction.

Muskeg: An ill-drained, often extensive, boggy tract, with at best sparse, stunted trees which occurs within the boreal forest. The vegetation is dominated by Sphagnum species (peat mosses) and Eriophorum species (cotton sedge).

Mycorrhizal: A mutually beneficial association between a mycorrhizal fungus and the root of a plant, which allows the plant root to take up nutrients more efficiently than an uninfected root. Some plants are incapable of normal development in absence of mycorrhiza fungi.

Mycorrhiza Fungi: Fungi which infect plant roots as part of a symbiotic mycorrhiza relationship. See Ectotrophic and Endotrophic Mycorrhiza .

N

Native Peoples: see Aboriginal and First Nations.

Native Species: A species that occurs naturally in an ecosystem without having been introduced by humans.

Natural Disturbance: See Disturbance.

Natural Productivity: The capacity to produce biomass; the production of biomass.

Niche: The functional position of a species in its environment, including its habitat, the period of time or season in which it occurs, and the resources that it obtains.

Non-Renewable Resource: A natural resource that is not capable of regeneration once it is harvested, extracted, or depleted. Includes resources such as fossil fuels and minerals. See Renewable Resource.

Non-Timber Forest Products: Abiotic or biotic materials (e.g., game animals, medicinal plants, fuel-wood, berries, mushrooms, etc.) from forests that are collected or harvested usually for small-scale commercial operations or for individual subsistence purposes.

Non Sufficiently Restocked: An area of forest land that has been clear-cut and the planted or left for natural regeneration; and which has not become sufficiently well established to meet a pre-determined stocking level.

Nutrient Cycle: The movement of elements essential to life from organism to physical environment to organism in a more or less circular pathway. A perfect nutrient cycle (e.g., the nitrogen cycle) has a readily accessible abiotic reservoir. An imperfect nutrient cycle (e.g., the phosphorus cycle) has a reservoir accessed only by slow-moving physical processes. Perfect cycles are thought to be more resilient than imperfect cycles.

O

Objective: A clear, specific statement of expected results to be achieved within a defined period of time related to one or more goals.

Old-Growth Forest: A forest dominated by mature trees that has not been significantly influenced by human activity. The stand may contain trees of different ages and a diverse array of plant species.

Open Decision-Making: A process in which all interested parties have the opportunity for meaningful input into a decision and a significant influence on the outcome.

Open Forests: A forest where tree crowns cover less than 20 percent of the ground, leaving open sunlit areas within the woodland.

Outbreeding: The breeding of a pair of plants or animals of the same species that are not closely related genetically. Compare Inbreeding.

Outfitter: A small commercial operation in which the proprietor provides clients with lodging, equipment, or guidance so that the clients can obtain an outdoor experience within a certain area. Activities may include hunting, fishing, hiking, camping, canoeing, or any other activity in predominantly natural areas.

Ozone: A form of oxygen (0^3) formed in the upper atmosphere by a photochemical reaction with solar ultraviolet radiation. A major component of smog. See Ground-Level Ozone.

P

Particulate: Refers to materials that are of minute size (i.e. particles).

Passerine Birds: Refers to an order of birds that are described as perching song birds. More than half of all extant bird species belong to this order.

Peat-land: Terrain that is covered by an accumulation of partially decomposed organic material due to excessive moisture and slow decomposition rates. See Bog and Fen.

Pesticide: Any chemical that kills, controls, drives away, or modifies the behaviour of a pest.

Photosynthesis: The conversion of atmospheric carbon to organic hydrogen-rich carbon compounds (i.e., carbohydrates) in the chlorophyll-containing cells of plants, algae, and certain bacteria. In plants and algae, water acts as a donor of hydrogen as well as a source of oxygen. Photosynthesis bacteria cannot utilize water and hence use hydrogen sulphide or organic compounds as sources of hydrogen, without a release of oxygen as a by-product.

Physiognomy: The structure and form of natural communities.

Planning: The organized process of identifying procedures and activities to be undertaken to achieve specific goals.

Pollutants: Any physical or chemical agent that adversely affects the health, survival, or activities of living organisms, or otherwise alters the environment in undesirable ways. Major chemical pollutants include sulphur dioxide, particulate sulphate, nitric acid, particulate nitrate, and ammonia. See Wet Deposition and Dry Deposition.

Population: A group of individuals of a single species occupying a particular area. See Ecotype, Individual and Ecosystem.

Population Dynamics: The fluctuations in population size and distribution brought about by changes in birth rates, recruitment, dispersal, mortality, immigration and emigration.

Primary Production: The total amount of photosynthesis minus respiration.

Pristine: A natural area that has had no anthropogenic disturbance since settlement of North America by Europeans.

Productivity: The amount of biomass accumulation over time by an individual, population, or ecosystem.

Protected Area: An area with legislated restrictions to limit human impact, including prohibitions on logging, hydroelectric developments and mineral and hydrocarbon exploration and development.

Puddling: The development of pools of water as a result of compacting heavy textured soils.

Pulp: Wood chips that have been ground mechanically into fibres and are used for the production of inexpensive paper, such as newsprint. Also may be chemically treated to remove lignin then used to manufacture higher quality papers.

Q

Qualitative: A type of measurement that describes the quality or type of a variable (e.g., type of precipitation). Compare Quantitative.

Quantitative: A type of measurement that describes the amount of a variable (e.g., total precipitation).

R

Recycling: The processes involved in reclaiming materials, for use in a product or service, that would normally have been discarded.

Redundancy: Functional repetition within a biological community which imparts flexibility and adaptability amongst the component species should one species decline or otherwise be removed from the community. For example, pollinators such as bees, moths, and birds can pollinate several tree species. Conversely, most tree species are pollinated by several types of animals. Compare Keystone Species.

Reforestation: A natural or anthropogenic reestablishment of trees within a naturally or anthropogenically denuded forested area.

Regeneration: The renewal of a forest stand following disturbance. May occur naturally from existing roots, stems or seeds; anthropogenically by direct seeding or planting; or as a result of dispersal of seeds by animals or wind from outlying areas.

Remote Sensing: The technique of obtaining information about objects through the analysis of data collected by instruments that are not in physical contact with the objects of investigation. Instruments used include photographic cameras, mechanical scanners, and radar systems typically carried on aircraft and satellites.

Renewable Resource: A natural resource that is capable of indefinite regeneration provided it is managed properly. Includes resources such as timber, fish, large game, fresh water. See Non-Renewable Resource.

Research: The systematic and logical search for answers regarding a particular question, phenomenon, or problem.

Resilience: A measure of the ability of ecosystems or their components to recover from natural or anthl l opogenic disturbances. Often measured as the number of years required to return to a pre-disturbance state!

Respiration: The biotic energy-yielding process of converting organic carbon into inorganic forms using oxygen. Respiration occurs in the cells of all living organisms including plants and animals.

Riparian: Related to the bank of natural body of fresh water.

Rutting: The development of artificial drainage channels in compacted, and/or displaced soil.

S

Sedimentation: The process of matter settling to the bottom of a body of water.

Siltation: The accumulation of sediment and loose rock particles in a waterway.

Silviculture: The theory and practice of controlling the establishment, composition, growth, and quality of forest stands. May include basic silviculture (e.g., planting and seeding), and intensive silviculture (e.g., site rehabilitation, spacing, and fertilization).

Slash: Woody material that has accumulated on the forest floor from natural causes or from logging practices.

Sludge: A soft, thick mixture, deposit, or sediment. Often a by-product of sewage treatment processes, pulp mill operations, or de-inking plants.

Softwood(s): Refers to the coniferous or cone-bearing trees of the division Gymnospermae, characterized by needle-like or scale-like leaves. Also refers to the wood of those trees. Compare Hardwood(s).

Soil Carbon Pool: The carbon pool occurring within soil.

Soil Compaction: The increase in soil density usually resulting from the use of heavy equipment or vehicles. Compaction has a negative effect on water and oxygen transport through the soil.

Species Richness: The total number of species within an area. Also known as alpha diversity.

Stability: The ability for an area to resist changes in species abundance or composition under disturbance or perturbation.

Static: Refers to aspects of ecosystems and ecosystem components that are unchanging in time or space. Compare Dynamic.

Stewardship: Responsible and accountable management of resources.

Stocking: A qualitative measure of the adequacy of tree cover on an area. Determined by examining crown transparency, number of trees, and basal area in relation to the pre-established norm for that area.

Subsistence: The food and shelter required to support life.

Succession: A predictable and relatively rapid order of seral changes occurring in an ecosystem over time, usually beginning immediately after a natural or anthropogenic disturbance (e.g., post-fire succession).

Sustainable Forest Management: Management to maintain and enhance the long-term health of forest ecosystems while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations.

Sustainable Harvest Rate: The rate at which timber may be harvested from a forest without hindering its future productivity, ecological diversity , or capacity for regeneration.

T

Trophic: Relating to nutritional relationships.

Trophic Web: A diagram which represents the nutritional or feeding relationships amongst the species present within a biological community.

Turbidity: The degree to which water clarity is impaired by particulate matter. See Light Penetration.

U

Understory: The area under a canopy of trees, usually with distinct shade-tolerant species compositions.

Ungulates: Any group of the hoofed mammals, most of which are herbivorous and carry antlers or horns.

V

Value-Added Production: A process of production which adds value to a primary product (e.g., producing newsprint from spruce logs) over and above the cost of inputs, such as raw materials and energy, used in their production.

Values: Principles, standards, or qualities considered worthwhile or desirable.

Variable-Retention Silviculture: A harvesting method which retains some forest cover.

Vertical Transport: Energy and matter flow from one species to another via a trophic link. Compare Horizontal Transport.

W

Vulnerable Species: A species that can be made at risk of extinction due to its low or declining numbers, small range, or other reason. Extinction risk is not as great as with threatened species or endangered species.

Water Movement: The net movement of soil moisture calculated as the difference between water under the influence of capillary action and water under the influence of gravitation.

Watershed: An area of land through which water drains into other streams or waterways via underground or surface streams.

Wet Deposition: Deposition of pollutants onto ecosystems via rain, snow, and fog. See Acid Precipitation.

Wetland: An area that is seasonally or permanently covered by shallow water, or land where the water table is near or at the surface. The presence of water in these areas favours the dominance of hydrophytic, or water-tolerant plants.

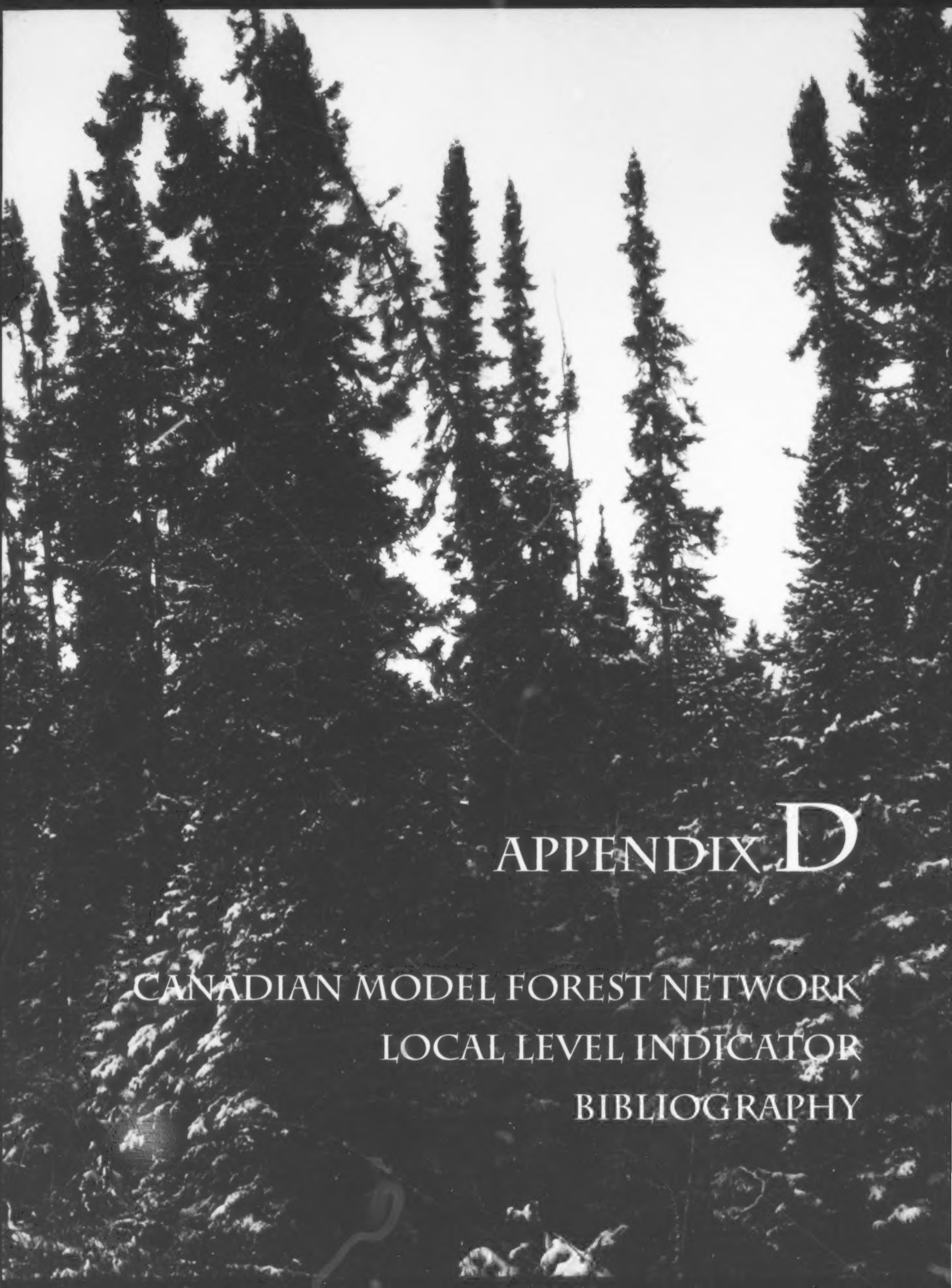
Wilderness: A part of the natural landscape that is sufficiently large and varied to constitute a more or less self-regulatory ecological unit, where human impact on the land, plants, and animals is minimal, and where the beauty and properties of the landscape have aesthetic, cultural or ecological significance.

Wildlife: Any undomesticated plants, animals, or other organisms that occupy a niche in the wilderness, form that wilderness, and depend upon it for their survival.

APPENDIX C

ACRONYMS AND ABBREVIATIONS

AAC:	Annual Allowable Cut
ANSI:	Area of Natural and Scientific Interest
BMP:	Best Management Practices
BOD:	Biological Oxygen Demand
BSLMF:	Bas-Saint-Laurent Model Forest
C&I:	Criteria and Indicators
CFS:	Canadian Forest Service
CIER:	Centre for Indigenous Environmental Resources
CMFN:	Canadian Model Forest Network
COSEWIC:	Committee on the Status of Endangered Species in Canada
CPPA:	Canadian Pulp and Paper Association
CSA:	Canadian Standards Association
CWD:	Coarse Woody Debris
DFA:	Defined Forest Area
DSS:	Decision Support System
DOC:	Dissolved Oxygen Content
DOM:	Dead Organic Material
EBM:	Ecosystem-Based Management
EIS:	Environmental Impact Statement
EMAN:	Environmental Monitoring and Assessment Network
EOMF:	Eastern Ontario Model Forest
FEC:	Forest Ecosystem Classification
FRI:	Forest Resource Inventory
FSC:	Forest Stewardship Council
FtMF:	Foothills Model Forest
FMF:	Fundy Model Forest
GDP:	Gross Domestic Product
GIS:	Geographic Information System
GNP:	Gross National Product
GPS:	Global Positioning System
IRM:	Integrated Resource Management
ISO:	International Organization for Standardization
IUCN:	International Union for the Conservation of Nature; World Conservation Union
LAMF:	Lake Abitibi Model Forest
LBMF:	Long Beach Model Forest
LLI SAC:	Local Level Indicator Strategic Advisory Committee
LLIWG:	Local Level Indicators Working Group
MAI:	Mean Annual Increment.
McMF:	McGregor Model Forest
MbMF:	Manitoba Model Forest
NCE:	National Centre of Excellence
NFA:	Nova Forest Alliance
NKS:	Naturalized Knowledge System
PAMF:	Prince Albert Model Forest
PSP:	Permanent Sample Plot
SERN:	Socio-Economic Research Network, CFS
SFM:	Sustainable Forest Management
TEK:	Traditional Ecological Knowledge
UNCED:	United Nations Conference on Environment and Development
WCMF:	Waswanipi Cree Model Forest
WNMF:	Western Newfoundland Model Forest



APPENDIX D

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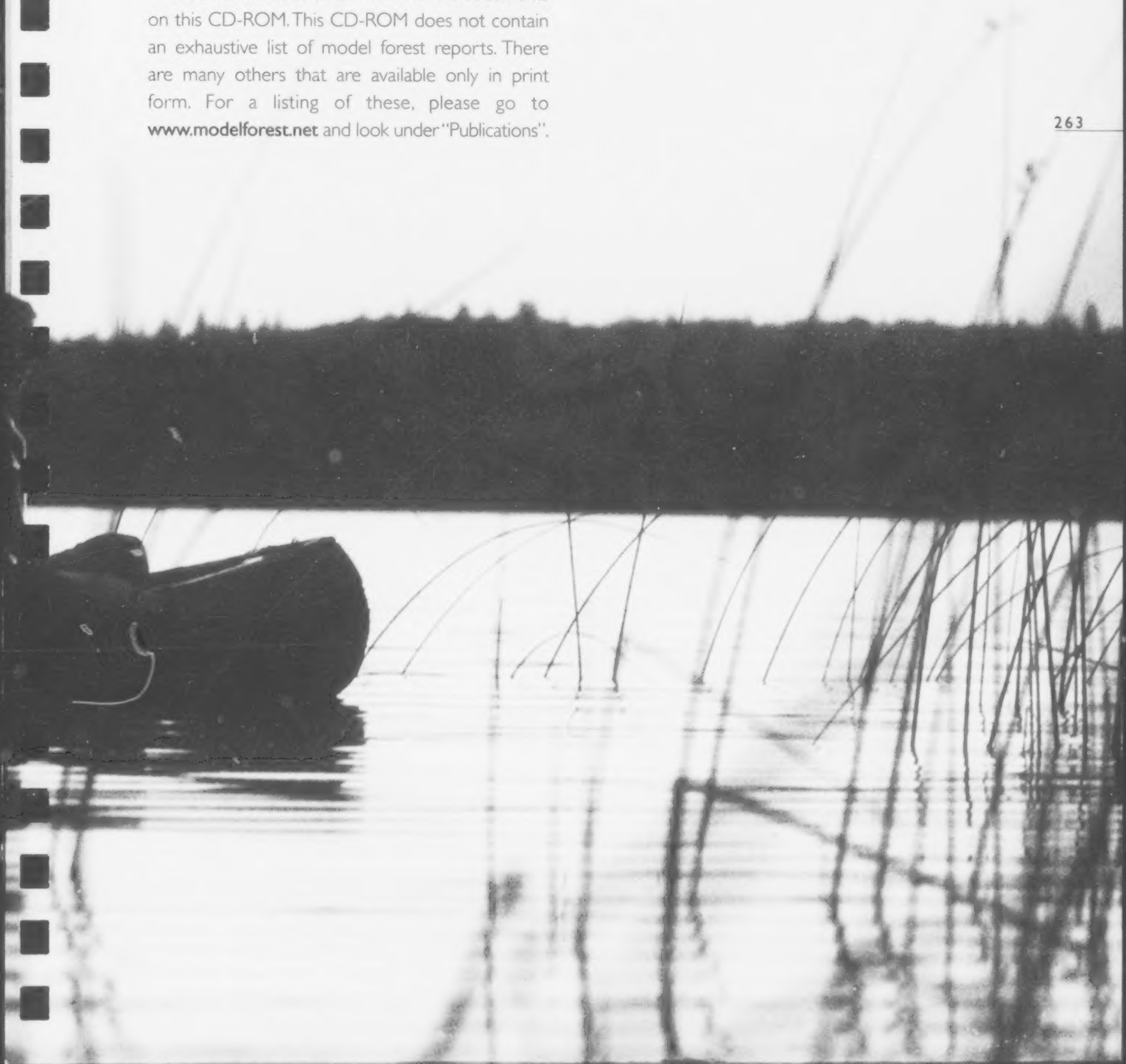
APPENDIX E

CANADIAN MODEL FOREST NETWORK LOCAL LEVEL INDICATOR CD-ROM

WHAT'S ON THE CD-ROM

The CD-ROM contains all the files in the document, *A Users' Guide to Local Level Indicators of Sustainable Forest Management: Experiences from the Canadian Model Forest Network*, marked with the following CD- ROM symbol: 💿

There are numerous other model forest documents on this CD-ROM. This CD-ROM does not contain an exhaustive list of model forest reports. There are many others that are available only in print form. For a listing of these, please go to **www.modelforest.net** and look under "Publications".



USING THE CD-ROM

The CD-ROM has been set up with a web-based interface to provide easy access to the documents. As such, you will need a web browser such as Netscape Navigator or Microsoft Internet Explorer, installed on your computer.

If the AutoRun feature is enabled on your computer, follow the instructions that appear on your screen. Otherwise, please use your web browser to open "Main_screen.html".

VIEWING THE FILES

This CD contains PDF files. You will need Adobe Acrobat Reader to open the PDF files. If you do not have Acrobat Reader installed on your computer, go to the Adobe website at **www.adobe.com** and follow the instructions for downloading the appropriate software for your computer platform.

THE MENUS

To assist you in accessing the CD-ROM and finding the information you are looking for quickly and easily, a simple menu system has been developed. There are four main sections to the menu: LLI Reports, Model Forest Toolbox, Contacts, and Links.

LLI Reports

LLI reports and publications are grouped by model forest.

Model Forest Toolbox

LLI reports are listed under various categories:

User Guides: Various local level indicator-related how-to reports and guides are located in this section.

Indicator Development Processes: Model forests have utilized a variety of approaches in the identification, selection and assessment of indicators reflecting the diversity of local circumstances and innovation among model forests. Reports from model forests on their indicator identification and development processes can be found here.

Data Gathering: Data collection is an essential component of local level indicator work, vital both for initial reporting as well as for ongoing monitoring. Look here for information on data gathering methodologies used by model forests.

State of the Forest Reporting: State of the Forest reporting, which utilizes local level indicators, provides information on a number of critical measures of ecological, social, and economic health related to a region's forests. Model forest publications relating to "State of the Forest" reporting can be found here.

Best Management Practices: Model forests have been instrumental in the development of a variety of Best Management Practices for sustainable forest management. Look here for information on "Codes of Practice", harvesting methodologies, and best management practices manuals.

Modelling: Model forests have assisted in the development of a variety of computer models and applications. Information on various GIS and other models and applications can be found in this section.

Biodiversity: *CCFM Criterion 1*. Conserving biodiversity ensures forests remain productive and resilient to disturbance. This section provides information on conserving biodiversity, monitoring biodiversity, and biodiversity research reports.

Forest Condition and Productivity: *CCFM Criterion 2.* Maintaining the health and productivity of forest ecosystems is an important prerequisite to sound stewardship and sustainable forest management. Information on ecological processes and natural disturbances including fire and insects can be found here.

Soil and Water Resources: *CCFM Criterion 3.* Physical environmental indicators are essential for monitoring sustainable forest management. Information on watershed studies and modelling, fish and stream inventories, and soil studies is provided in this section.

Global Ecological Cycles: *CCFM Criterion 4.* Forests play an important role in global ecological cycles by recycling the Earth's water, carbon, oxygen, and other life-sustainaing substances. Look here for information on carbon budget accounting and global cycles.

Multiple Benefits: *CCFM Criterion 5.* Forests provide a multitude of benefits — commercial, environmental, cultural, and spiritual — to all Canadians. Information on social and economic values and non-timber forest products can be found in this section.

Society's Responsibility: *CCFM Criterion 6.* Sustainable forest management the responsibility of all Canadians, not just government and industry. This section contains information on Aboriginal-related indicators, public participation, and forest community sustainability.

Contacts: Find out how to contact the Canadian Model Forest Network for more information.

Links: Find out what else is happening in LLI at model forests and around the world. ◆

MODEL FOREST NETWORK
◆
RÉSEAU DE FORÊTS MODÈLES

CANADIAN MODEL FOREST NETWORK
READER FEEDBACK

This document, *A Users' Guide to Local Level Indicators of Sustainable Forest Management: Experiences from the Canadian Model Forest Network*, covers information on processes, protocols and methodologies developed for the identification, development, monitoring, reporting, use and application of local level indicators. The document is essentially be a "how-to" manual on local level indicators based on work done within the Canadian Model Forest Network. Your feedback on how to improve this document would be greatly appreciated.

Did the Users' Guide to Local Level Indicators provide a good general overview?

○ Not enough detail
○ Just the right amount of detail
○ Too much detail

Did the document increase your understanding of local level indicators of sustainable forest management?

○ Increased my understanding significantly
○ Increased my understanding somewhat
○ No change

Were the "Experience Gained" and "Lessons Learned" boxes useful?

○ Very
○ Somewhat
○ Not at all

Was the report easy to read?

○ Too technical
○ Just right
○ Too simple

Did you like the layout of the report?

○ Well designed
○ Difficult to follow

Was the listing of indicators and data information for each model forest useful?

○ Very
○ Somewhat
○ Not at all

How much of the report have you read?

○ All of it
○ About half of it
○ Less than a quarter of it

Which sections were of most interest to you?

○ Individual model forests (section 3)
○ Activities of the Model Forest Network (section 4)
○ Trends and Commonalities (section 5)
○ Indicator lists
○ "Experience Gained" and "Lessons Learned"

Additional comments or suggestions:

SEND YOUR COMMENTS TO:
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Canadian Forest Service
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e-mail: lli@modelforest.net

Name:
Address:

City:
Province / State:
Country:
Postal / Zip Code:
E-mail:

NOTES

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